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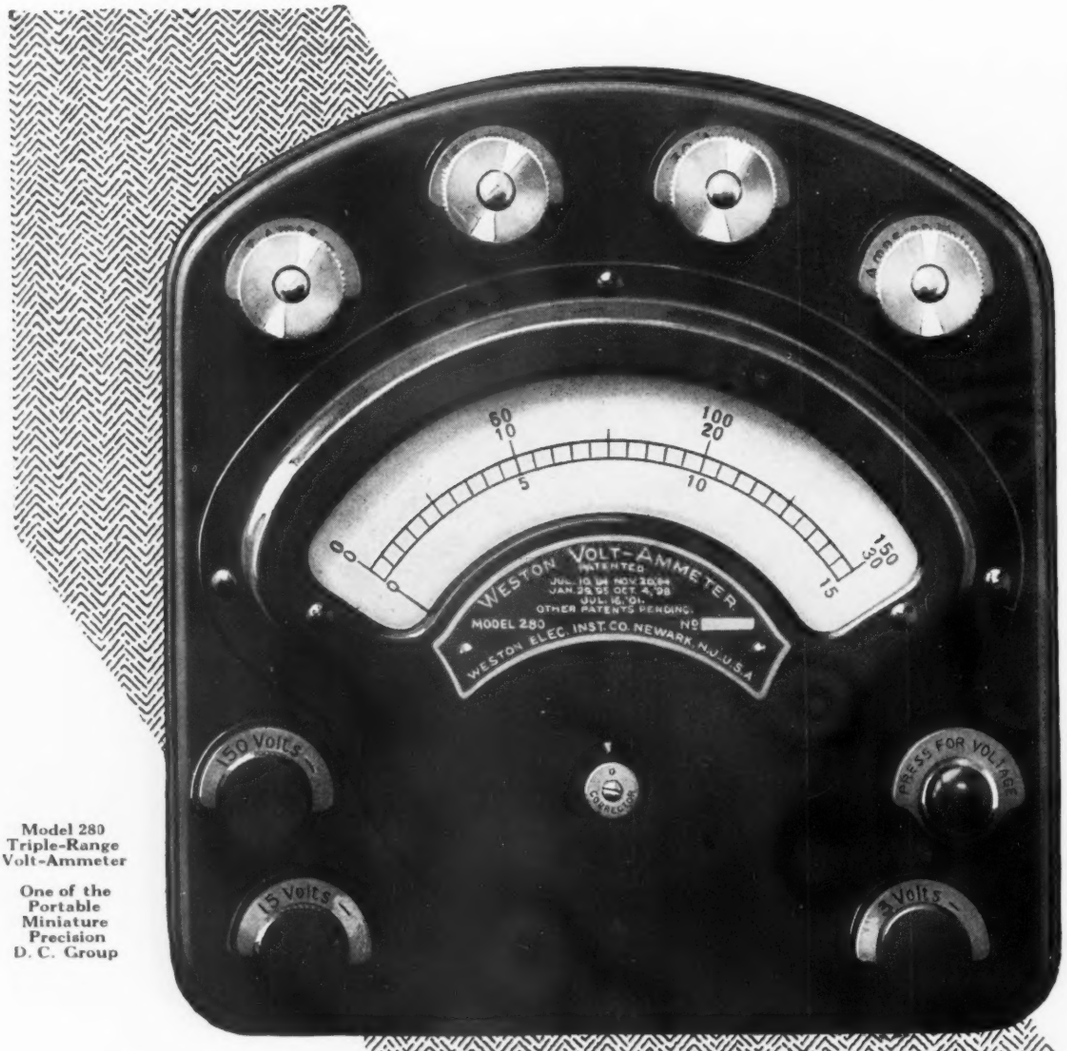

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Electrical World

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The Victory Convention

THE Victory Convention of the National Electric Light Association has passed into history. Underlying every activity at Atlantic City were a glorious sense of triumph, a joyful renewal and enlargement of friendships, and a deserved satisfaction that in our country's time of need the electrical industry contributed in unstinted measure its part to the epoch-making outcome.

The solidarity and worth of the association have met the test of war, and the return to more normal conditions is being rapidly achieved. The proceedings were rich in interest and reflected alert contact with the problems and thought currents of the new era. Conscientious work for the good of the industry bears ripe fruit on such occasions. Delegates went away with a new conception of their united power to carry the electric utility industry to higher planes of public service, with a new determination to live by President Wells' all-embracing psychological equation, "The revenue from contented customers must equal a satisfactory return for capital and labor."

The spirit of helpfulness and loyalty exhibited in the relations of employer and employee in the association augurs well. The educational opportunities offered to member-company employees, the application of bonus systems and the encouragement of initiative reflected in the convention proceedings index the attitude of those in responsible command toward their valued helpers, whose enthusiasm and loyalty evidence sound conditions in company families.

In large undertakings some mistakes are inevitable. Hostile critics magnify defects which, though irritating, detract but little from the sum total of accomplishment. Time is required to clear away the débris of constructive effort and to remove minor difficulties in the functioning of new or reconstructed enterprises. As for the electrical industry, it has done more than well in meeting post-war problems and will continue its good work toward attaining the new normal of activity.

William Dixon Weaver

A GRACIOUS tribute was paid to W. D. Weaver, former editor of the ELECTRICAL WORLD, at the meeting of the American Institute of Electrical Engineers last week. It is not often that men have such honors paid to them while still in the flesh, but then Mr. Weaver is an exceptional man and well deserving of the homage of the profession for which he labored so well and for so long. Modesty totally unbecoming a master builder and yet so rich and so rare caused him to shrink from public gaze; but a beacon cannot be hid; his work and worth became known, and in a lasting and fitting tablet the electrical profession records its appreciation. Those who have labored beside him and who know him best rejoice in this recognition and are proud to have been associated with him.

Now is the time to drive home by the best possible service the conception that under private ownership and management public utilities can hit a pace which unwieldy and near-sighted government management can never overtake. To-day we can capitalize a brief but significant period of public mismanagement of great utilities, and to the lasting benefit of the people and the electrical industry.

The Edison Medal to Benjamin G. Lamme

THE Edison medal has properly come to be regarded as an engineering "distinguished service medal" for electrical achievement. The history of this medal is very interesting to read, and the deed of assignment to the administration of the American Institute of Electrical Engineers is a most remarkable document in its originality and incisiveness. A number of the leaders in electrical engineering have already received the medal, and there has never been any question as to the validity of the awards.

This year, at the recent annual meeting of the American Institute of Electrical Engineers, the Edison medal was tendered to Benjamin G. Lamme, who has been the chief engineer of the Westinghouse Electric & Manufacturing Company of East Pittsburgh since 1903, and who has been in the engineering service of that company since 1889, a continuous period of thirty years. Altogether apart from the acknowledged merits of Mr. Lamme's engineering inventions and developments, it is a great satisfaction to see the medal given to a man with such a record of faithful and continuous service. On this side of the Atlantic the restlessness of spirit which frequently serves us well in kindling ambition too often serves us ill by inciting to change of purpose or mere vagrancy of effort. It is therefore the more desirable to see persistence of endeavor and steadiness of purpose come into the possession of the rewards which they tend to attain.

In addition to this notable achievement of loyal service to the industry, in which he entered as a youthful aspirant, Mr. Lamme's reception of the Edison medal will be acclaimed by all who know of his work. He has shown great insight into scientific principles, great patience in applying them, great courage in developing them and great tolerance to adverse criticism at all times.

Underground Construction and Electrolysis

AT THE convention in Atlantic City of the National Electric Light Association an interesting report was presented from the committee on underground construction and electrolysis. The technical data obtainable by the committee, as they appear in the report, are much more extensive than would have been possible a few years ago. No doubt, the various companies with extensive underground systems are finding it advantageous to study these systems carefully.

A remarkable set of data appears in the report concerning the current-carrying capacity of various sizes of duct cable under the streets at different seasons of the year. It appears that the continuous ampere loading that is possible in winter is roughly about 50 per cent greater than that which can be tolerated in summer. This is the more fortunate when it is remembered that the peak load for the year in city central-station systems usually occurs near Christmas. If the greatest demand of the year occurred at midsummer, when the ground is hottest, the result would be economically most unfortunate for the companies. Some central-station men contend that the existing relation is a distinct evidence of the influence of a beneficent Providence in the affairs of men and cables. In any event, it is a great boon.

The committee makes a number of useful specific recommendations of a very practical nature, and the report will be well worth studying by all classes of electrical men.

Money expended on heat-value determinations and chemical analysis of fuel yields a high return. It is no longer necessary to accept inferior grades of fuel forced into the bunkers by war necessities or by profiteering mines. Combustion engineering is a vital factor in plant operation with advanced fuel prices, and the chemist is needed in boiler-plant service no less than the efficient stoker.

Report of the Pacific Coast Public Policy Committee

WE ARE presenting this week the report of the public policy committee of the Pacific Coast Section of the National Electric Light Association. This document has a very direct application not only on the Pacific Coast but elsewhere, for it deals with the fundamentals of the relations between public utilities and the public. The Coast, like the rest of the country, found itself under the pressure of tremendous industrial stimulus, bearing particularly on shipbuilding and on agriculture. If we remember correctly, some records were established in the former industry on the Coast which will stand long before they are surpassed in peace or war. The demands of agriculture were no less strenuous and are particularly associated with the work of public utilities, because perhaps nowhere else in the world is agricultural effort more closely connected with electrical development. Not only is the distribution of energy peculiarly widespread and efficient, but the origin of this energy is definitely correlated with the irrigation work on which successful agriculture so largely depends.

Were we to pick out one vital point forced to the front by the report before us, it would be the necessity of liberal action on the part of the government if electrical transmission is to be of the most direct and potent aid to the community. Much was done on the Coast during the war in the interconnection of transmission systems, until the various networks there operating have been so thoroughly tied in that there are but four small gaps to fill to complete a busbar from Oregon to Mexico. But the government still interposes such grave obstacles in the way of the development of power upon the public lands that the great resources of the Coast, instead of being worked to their utmost, establishing reservoirs for power and irrigation alike, are still handicapped, enterprise is stifled and the resources of the country remain only partially developed. The last Congress, wasting its energy in futile debate, adjourned before it passed the water-power bill, a bill not altogether what might be desired, but still helpful. The fact is that a certain Bolshevik element in Congress so recoils from the idea of rewarding private enterprise in its effort for the country's benefit that it willfully prohibits the development of hundreds of thousands of horsepower that are now running seaward unutilized. The electrical utilities of the Coast are doing all that they can to conserve power. It is estimated that the interconnections now made or planned will preserve to the uses of mankind over 100,000,000 kw.-hr. per year, a quantity which could be enormously increased were decent opportunity offered for utilizing the waterfalls that are running to waste. The engineers on the Coast—and they are second in ability to none in the world—hold that under the intensive development of hydraulic resources for power and irrigation the Coast States alone could be made productive enough to feed the whole country. It is time for Congress to realize that it must not subordinate public gain to a frenzied effort at preventing private gain.

It is fortunate indeed that this distorted view of duty has not extended to the commissions on the Coast. They have seen the burdens imposed on the public utilities by the greater costs of material and labor and have responded by authorizing the addition of surcharges in a form permitting of future adjustments. These, of course, bear the impress of a war measure, but they are and probably will be adjusted in a spirit of fairness to conditions as they from time to time exist.

The report shows how keenly the utilities feel their close relation to the public and their common interest with their employees in rendering the maximum service possible. There is a feeling abroad that there can be closer coöperation between the management of utilities and those who labor to make them effective, a feeling that the worker should be a partner in the business and should realize that his prosperity, like the prosperity of the public, is bound up with efficient service by the utility of which he is a vital part. Pursuant to the general patriotic duties of employers, the committee recommends as a universal policy the reëmployment of all workers who have served their country during the war, even though it should temporarily contravene the ambitions of managers to keep down to the lowest possible limit the costs of operation. In other words, this committee stands for a square deal with employees and the recognition of those who have thrown aside their means of livelihood to serve their country. It feels that the possibilities of electric distribution on the Coast are almost limitless, and that when Congress abandons its dog-in-the-manger policy with respect to powers on public lands the greatest possibilities can be realized. To accomplish this it is necessary not only to have enlightened legislation but a campaign of education which will

show to the people at large the full benefits to be obtained and the determination of the public utilities to realize these benefits and to share them with the public they serve. Such is the import of the notable document which we here place before our readers. It brings a broad-minded spirit of coöperation and a realization of duties and responsibilities that leave little to be desired, and it deserves the most thorough consideration both by those who are charged with a great and important public duty and by those whom they serve.

The amount of nursing required by the transatlantic airplane power plant emphasizes by contrast the superior reliability of electric motor driving in fields where an appropriate energy supply is available. The precautions taken before "hopping off" are wise and right—but how the electrical men aboard must think "My kingdom for an induction motor!"

The Report on Electrical Apparatus

TO SUMMARIZE adequately the valuable report of the committee on electrical apparatus to the National Electric Light Association is almost an impossibility. The report contains more than 100 pages of valuable material which must be read in full to grasp its real importance. The most that one can do is to direct attention to some specific things which seem to point the way of progress. The first matter to strike one's attention is fire protection for generators. Setting aside the general protection of stations, there have been reported by thirty companies more than eighty fires occurring within the last three or four years. These arose within the generators, in about equal measure from causes external to the insulation and those chargeable to the conductors themselves. Dirt, mechanical defects, short circuits and grounds were the chief causes, and from all combined the fire menace seems to be sufficient to justify special means of protection. Primarily these are designed to cut the endangered generator clear of the system so that the fire may be treated; secondarily they deal with extinguishment as such. Protective equipment means in many instances the installation of relays specifically to protect the generator and its leads and to cut out automatically the main switch, the neutral switch, and finally the field switch.

Then comes the extinguishment problem, which generally speaking comes down to the employment of water or steam, the preference lying rather with the latter. In both cases the protective apparatus is carried inside the end bells of the generator and can be turned on at short notice. As a matter of practice it is found that the damage done to the insulation by steam or water is trivial compared with that already accomplished by the starting of a fire. As in generating apparatus so also in switchboards, the tendency is toward playing for safety and the use of more and better protective precautions. Circuit breakers and switches are, in the opinion of the committee, on the whole provided with too small factors of safety, especially where automatic reclosing devices are applied to the circuit breakers. One valuable suggestion is that the committee should gather data on the actual use of circuit breakers after a short circuit, with a view of obtaining information as to the real duty which may be imposed upon them, so that a better determination of the factor of safety may be had. With air-break switches there is still greater need for a sound basis for ratings, especially since any tendency toward overheating largely increases the risk.

Transformers are now fairly well standardized for all the moderate voltages, but it is believed that extensions should reach out for larger capacities both in total output and in voltage. A significant sign of the times is that the three-phase transformers now standardized rise to 30,000 kva. capacity, while suggested voltage ratings reach up to as high as 220,000 volts. This leads directly to modern substation practice, drifting more and more to outdoor types, and a strong tendency is noted of late toward the use of three-phase transformers rather than the single-phase types hitherto the more familiar. The substations are commonly protected against overload by oil circuit breakers, although in the smaller capacities fuses are often used and considerable recent experience has been gained with automatic air-break circuit breakers, of which many are in use up to 44,000 volts and a few at 110,000 volts. In the case of one company the transformer is deliberately treated as part of the line, and the only protection is on the low-tension side. Much progress has been made in the direction of automatic substations, of which about forty are recorded as in use, chiefly for railway purposes. Stations here referred to are those containing rotating apparatus of one kind or another, besides which there are many automatic or semi-automatic alternating-current stations which hardly need particular notice. Great ingenuity has been shown in the working out of motor-operated controllers for the substations, in which a remote-control motor in a perfectly orderly manner puts the machines into full operation.

It is worth noting that in synchronous converters the tendency is drifting more and more to 60-cycle apparatus, which seems at present, particularly when properly equipped with flash guards and rapid circuit breakers, quite as reliable as that for lower frequency, while it is, of course, much more desirable if part of a general distribution system doing all classes of work. The use of synchronous apparatus with special reference to correcting the power factor is assuming large importance, whether it takes the form of synchronous motors adapted incidentally to power-factor correction or that of unloaded synchronous condensers used purely for regulative purposes. Both are in large use, the tendency being perhaps to use the synchronous motors wherever possible and the more highly specialized machines when in the absence of proper motor load they become necessary. The revival of the static condenser as a power-factor regulator is an interesting recent development. Used more than a quarter of a century ago in connection with induction motors, it dropped out of sight for a long period, but it has now returned and is in use to a total capacity of about 3500 kva. In small units at least it appears to be less costly than synchronous condensers and promises to be a useful addition to present resources for power-factor control. Of the importance of such control the committee has much to say, giving data on the costs of meeting the necessary requirements by static and synchronous condensers or by synchronous motors and giving important information regarding the power factors to be expected in various special classes of work, particularly the electric furnaces now in large use.

Plans for the Future in N. E. L. A. Convention

Large Gathering at Atlantic City This Week for the Forty-second "Victory" Meeting Combines the "Old-Time" Convention and the New Outlook—R. H. Ballard of Los Angeles Elected President

IT WAS an "old-time" gathering that the interested members of the National Electric Light Association planned for their forty-second convention at Atlantic City this week. They succeeded well in accomplishing what they had planned, and they also reached out to grasp firmly the new problems which are arising with the new times now developing. Outside of the weather, which they could not help, conditions were auspicious. Registration, attendance at meetings, study of the fine exhibits, were gratifying. From the address of President Wells and the election of R. H. Ballard, the first Pacific Coast president, stimulation was obtained. Dr. George Otis Smith gave a closer view of the program of Secretary of the Interior Lane for study, conservation and development of the nation's power resources, which received the indorsement of the convention. The outline of "The Importance of Electrochemistry," by Prof. Joseph W. Richards, pointed a way to development which will undoubtedly have more intensive consideration. Socialism and its growth of municipal-ownership propaganda are to be combated. Labor questions, including profit sharing, will be taken up by a committee to be appointed in the coming year. All in all, it is clear that the convention outlined much useful work for the new administration which will be under the executive head of the association's first president from the Pacific Coast.

Opening Session

President W. F. Wells called the opening general and executive session together a few minutes after 10 o'clock on Tuesday morning. He spoke of the cordial welcome which had always been given to the association by Atlantic City and then introduced Mayor Bacharach. The Mayor referred to the delegates as representatives of a great industry who have done a most wonderful work during the war period. He called for 100 per cent Americanism and expressed the opinion that the war will be followed by a more easy settlement of the question of labor and capital. His patriotic remarks were received with great applause.

Vice-chairman R. H. Ballard then formally presented President Wells, who read the annual address. Mr. Wells was followed by the delegates with close attention as he spoke of the sweeping change between the conditions of last year and those of this year.

"To-day we cannot honor too highly," he said, "the brave men who offered their lives nor the brave mothers who offered their sons in the great cause, nor should we fail to give due credit to those who gave up their vocations to serve their country or to profesional men and others who devoted their entire energy to the work behind the lines."

Since the armistice was signed the industry has been working to readjust its business, not to the pre-war basis, but to an entirely new basis in which there are many unknown factors. "As we were able during the war to meet and solve the unforeseen problems presented," added Mr. Wells, "so we will now go forth in the same spirit and cope with those that are to come."

President Wells announced that at a recent executive committee meeting consideration was given to the need of the association for a managing director or some similar permanent officer with a limited technical staff to handle the important problems arising all over the country. A committee will report on this matter to the incoming administration. The association has joined the National Industrial Conference Board.

Mr. Wells then discussed the rising cost of operation, covering supplies and capital. He referred to the authority given to some companies for increased rates and said that other companies have been able to meet the requirements by intensive development of existing plant, by curtailment of extensions for other than war purposes, and by using reserves. The conclusion expressed by Mr. Wells was that experience, thought and judgment will be required to determine future policy regarding development. The uncertainty of the future makes a short-term note at high interest rates probably the most favorable competitor of tax-free investments.

The speaker thought that it would be unwise to belittle the strength or power of the radical socialistic

element. From this point he led to a discussion of municipal ownership. As the association is educational in character, President Wells expressed the opinion that its efforts should be devoted, during the coming year, to showing the taxpayers the danger of incurring debts for the purchase of public utilities and the bankers and investors the dangers of marketing large blocks of municipal bonds to acquire utilities that can be administered more economically under government regulation by private interests than by public officials selected by the popular vote. In conclusion Mr. Wells said:

"From now on our particular duty is to the people. Our duty to that part of the people who are our customers is to render them satisfactory service. Our duty to those who are our employees is to maintain loyalty by fair treatment. To those who own our securities it is to maintain the integrity of their investments. Our duty to others of the commonwealth under whose rules and regulations we operate is to furnish convincing information that we are giving them a better service for less money than can be obtained in any other way. Our business is founded on an economic basis, and, if wisely administered and not hampered by unfair treatment, can continue mutually beneficial to the customer, to labor, to capital and to the commonwealth."

PRESIDENT-ELECT BALLARD

Vice-chairman Ballard appointed the following committee on the president's address: Charles L. Edgar, John F. Gilchrist and J. E. Davidson.

Acting Secretary S. A. Sewall read a telegram from President Wishon of the Pacific Coast Section conveying felicitations and a cordial invitation to members to attend the convention of that section in April, 1920. Mr. Wishon expressed the feeling that the contact between the East and West among members of the electrical industry is of vital importance.

Secretary Sewall also read a telegram to Mr. Wells from Samuel Insull expressing regret that owing to delay in his return home from Europe it was impossible for him to be at the convention.

W. H. Johnson, in speaking with much regret of the absence of John W. Lieb on account of illness, moved the appointment of a committee of three to telegraph sympathy and good wishes to Mr. Lieb. President Wells appointed as the committee Mr. Johnson, W. H. Atkins and Martin J. Insull.

Acting Secretary S. A. Sewall then made his report referring to the work done by committees during the year.

As the representative of the N. E. L. A. on the electrical committee of the National Fire Protection Association, W. H. Blood, Jr., insurance expert, stated that he had opposed injurious rules proposed for inclusion in the National Electrical Code and that in general his suggestions had been given due consideration by the committee. He also assisted member companies in settling damage suits where fires were attributed to electrical causes, not one decision being rendered against a member company in a suit in which he had been summoned.

RATE RESEARCH

Alex Dow, chairman of the rate research committee, reported verbally. During the last year as in the year immediately preceding this committee held no stated meetings. It continued the publication of *Rate Research* and the "Rate Book" and answered such questions as were received by the chairman or members by direct correspondence. *Rate Research* has justified its existence. Without actually expressing the opinion of the committee as a committee, but voicing the opinion of a number of members of the committee, Mr. Dow said that they would rather see the "Rate Book" continued for another year or more on its present general plan and under normal business conditions before an attempt should be made to either better it or withdraw it.

In the very rapid action regarding rates which has characterized the last two years, due to war conditions, the only thing the committee could do to good purpose, said Mr. Dow, was to watch and record and study the evolutions of the subject that was changing in color and scope almost daily and which would likely have a temporary value and not lead to permanent results. Mr. Dow said that he looked for no new rate theory or method of any kind. The intent of the surcharge is to make it clear that the commission considers conditions only temporary.

"That the conditions which surround these increases shall be temporary is our hope," he said, "but I may remind you that costs have not gone down and that the conditions that warranted these numerous rate increases and the addition of surcharges remain with us and that this period of readjustment is not likely to be a period of retrogression in costs."

How the coal clause has worked during the year is a matter of interest, but how it will work in continuing contracts in peace times is a matter of still greater interest, added Mr. Dow. The position of companies in adjusting coal clauses where they are loaded with supplies bought under contracts at high prices and which complicated their coal cost by purchases in open market or through the product of their own mines is not going to be so simple as that of the companies which buy by contract in a well-established market.

In concluding, Mr. Dow said that much work is to be done for the coming year. There is the further study of rate problems. Nothing is in view that will be revolutionary. It will be rather a determination of what progress has been made and to get an indication of

the possible progress in the future than the announcement of any new discoveries.

Frank W. Smith said that the members should support the publications of the rate research committee and make them entirely self-supporting.

M. C. Ewing, F. S. Price, R. H. Ballard, W. L. Abbott and Stephen Bennis discussed the report. Mr. Dow answered the various questions raised.

SECOND GENERAL AND EXECUTIVE SESSION

Sale of Company Securities—Public Policy Report—Activitied of National Committee on Gas and Electric Service

As at other conventions, the public policy session was different in character from the regular business sessions. It was held on Tuesday evening and the meeting place was changed on account of inclement weather from the Million-Dollar Pier to the Hotel Traymore. The room was filled to both standing and seating capacity. It was the same room in which the "win the war" convention was held last year. In the absence of W. H. Hodge, chairman of the committee on sale of company securities, to customers and resident citizens, the report of this committee was read by John G. Learned.

PAST-PRESIDENTS TAIT AND FRUEAUFF

PUBLIC POLICY REPORT

W. W. Freeman, as chairman of the public policy committee, then presented as an oral report on behalf of that committee. In explaining why the report was informal in character, Mr. Freeman said that the committee had already made an interim report regarding reconstruction matters. The committee was in session during the evening up to the time the meeting was called.

Mr. Freeman spoke of the striking contrast between conditions of a year ago and those prevailing to-day. At the last convention the dominant purpose was the winning of the war, and every consideration not tributary to that result was brushed aside as of no importance. It seemed then that a long struggle was ahead, with vast sacrifice of life and property. The determination was to make any sacrifice to win the victory. Thanks to the indomitable bravery of the men in service and a plan of preparedness late in starting but overwhelming in scope and importance, the spirit of determination of months ago has been crowned with success. Now that the war is over, it is time to start afresh to renew business activities, said Mr. Freeman.

Mr. Freeman then discussed the subject of socialism. One element in socialism which affects the interest of member companies most directly is the advocacy of municipal ownership. This is not particularly a danger in the view of many people, but it should be watched. Mr. Freeman called attention to the difference between the man who advocates municipal ownership as a question of economics and the one who advocates it because he believes in socialization of the country. The former can be reached by argument and a showing of the of socialism and of municipal ownership is urged by facts. The latter will continue to advocate socialization irrespective of any financial considerations. The spread of socialism and of municipal ownership is urged by an active propaganda which receives support in many quarters.

The problem of a counter propaganda has had the thought of the committee almost continually, said Mr. Freeman. The committee was not prepared then, however, to outline any specific plan of action. It desired, however, to point out to the member companies the importance of action by them to inform themselves on the questions involved.

The announcement was made by Mr. Freeman of the fact that the association some months ago added F. G. R. Gordon of Haverhill, Mass., to its staff. Mr. Freeman spoke on the personal and strong conviction of Mr. Gordon on the subject of socialism and municipal ownership. Mr. Gordon as a member of the staff is at the service of members in investigating and writing on the subjects to which he has given such long study.

NATIONAL COMMITTEE ON GAS AND ELECTRIC SERVICE

In the absence of John W. Lieb, Charles L. Edgar presented an outline of the report of the National Committee on Gas and Electric Service. When the United States declared war on Germany, the difficulties under which the gas and electric companies were operating were very great, and still more serious conditions were imminent. The dependence of practically every important industry in this country upon gas and electricity, which had been steadily growing, came to be more thoroughly realized after the outbreak of the world war in the summer of 1914. The new demands upon these utilities during the two years that followed taxed the capacity of the existing plants throughout the country to the utmost. The heavy demands of the large manufacturing establishments filled with work for the different European nations engaged in the war were met successfully in spite of the increasing difficulties to be overcome. Growing congestion in transportation became still worse when the mobilization of our armies took place. More than ever must all factories producing war material be kept going. Additional factories would have to be supplied with power by the electric plants. These conditions led to the formation of the National Committee on Gas and Electric Service, whose services were placed at the disposal of the government.

"To recite the activities of the National Committee on Gas and Electric Service," says the report, "is to tell of the patriotism shown and the loyal service that through its guidance and direction was rendered by the utilities companies of the country. The men of the gas and electric companies formed an army of defense which contributed its full share toward winning the war."

THIRD GENERAL AND EXECUTIVE SESSION

Company Sections Report—Amendments to Constitution—A Discussion on Power Resources of the Country

After concluding his presentation of the review of the report, Mr. Edgar said that the report reflected the modesty of the chairman. He thought that no one had ever done as good work for any industry or any government as Mr. Lieb and George W. Elliott, the secretary, had done for the committee.

F. G. Gordon then made an address on "The Trend of Socialism." He discussed the menace in the world-wide active socialist movements and pointed out many illustrations of waste in government expenditure and operation in this country. Mr. Gordon spoke with great earnestness and was followed intently by the large audience which crowded the room. He was frequently applauded, and in its enthusiasm the audience rose to its feet at the conclusion of the address.

Before this session adjourned Mr. Freeman offered a resolution, which was adopted, expressing appreciation of the service rendered by the National Committee on Gas and Electric Service and providing that its report be printed.

After calling the third general and executive session to order on Wednesday morning, President Wells asked Frank W. Smith to present his report as treasurer. Mr. Smith showed that the association is in a satisfactory financial condition notwithstanding the somewhat detrimental effect of the war. The report was accepted.

Nominees for the nominating committee were then made. The following were duly elected: L. A. Ferguson, Henry L. Doherty, J. B. McCall, W. W. Freeman and Charles L. Edgar.

Walter Neumuller, chairman of the membership committee, made the report of that committee. This showed the decrease in membership which continued during the war period. The largest single factor was the static condition of the company sections. Some of these sections had been disbanded, and others had been doing nothing as a result of the war. Mr. Neumuller said that it was not at all improbable that a substantial increase would be recorded in company members and that with the return to normal activities in the geographic and company sections the committee is confident the turning point has been reached and the membership will show a satisfactory increase.

F. A. Birch, chairman of the committee on company sections, read the report of this committee.

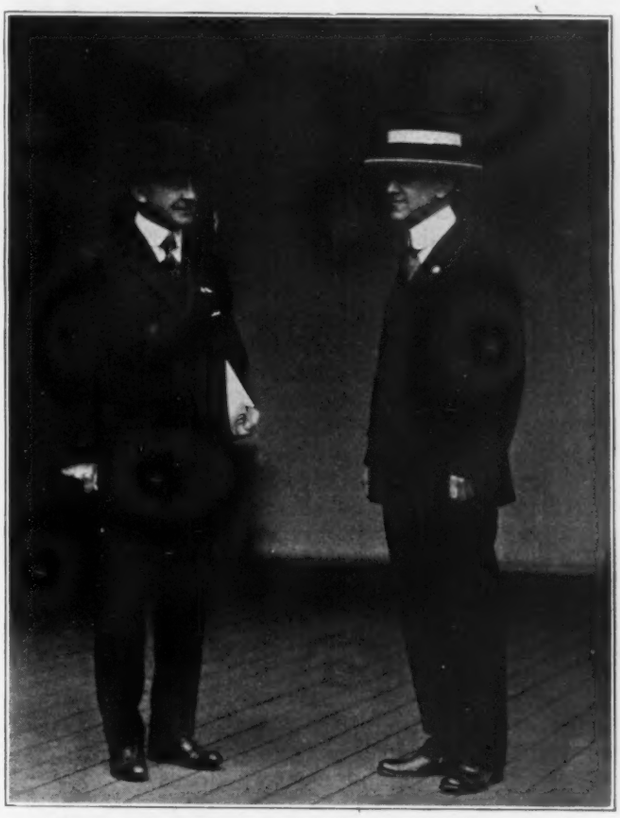
Two amendments to the constitution were brought up for action by the committee on company sections, of which Frank A. Birch is chairman. The objects were to afford a legitimate standing for those employees of central stations who cannot or will not spend $5 to become a Class B member of the national association, and to dignify Class B membership and make it a distinction and an honor.

William C. L. Eglin, M. S. Seelman, Jr., and H. W. Stevens discussed the report. Mr. Eglin felt that it was on the company sections that the future of the association depends. Mr. Seelman believed that it would be desirable to work out some method which would be at once educational, instructive and entertaining for members. Mr. Stevens said that it was important to adopt methods that would attract individual members to the meetings.

William C. L. Eglin, chairman of the committee on constitution and by-laws, read the report of this committee. Two amendments were suggested dealing with company sections. The ommission of the word "fixed" in connection with yearly dues in Acticle 17 was also suggested. The proposed amendments were adopted.

PLANNING FOR POWER

An address was then made by Dr. George Otis Smith, director of the United States Geological Survey, on



T. I JONES AND PRESIDENT WELLS

"Planning for Power." Dr. Smith discussed the ideas underlying the proposal of Secretary of the Interior Lane for an investigation of power resources in the entire country and in the Atlantic seaboard district. Dr. Smith said that during war time the remedy advocated for power shortage was restriction of industry. Electrification is the peace cure. He showed the possibilities of saving in power cost through electrification by saying that motive power accounts for fully 30 per cent of the expense of operating steam railroads and for about

The figures presented by the Alabama Power Company in its comparison of steam plant with hydro plant show the ratio of men employed as eighty-four to one. It is time to count the rising costs of labor in the steam plant where the coal miner as well as the fire-

man is an employee in fact. To the 1000 kw. capacity, twelve and one-half men in the steam plant and coal mine adjacent compare with one-sixth of a man in the hydro plant. Dr. Smith directed consideration to the recognition of cheap power as one of the peace needs in France and Great Britain. From the proposed power system in the so-called Boston-Washington district would flow the energy to serve a score of railroads, hundreds of public-service companies, thousands of manufacturing plants and millions of homes.

Directly upon the conclusion of Dr. Smith's address, W. W. Freeman voiced appreciation of the courtesy of the speaker in coming to address the association. The address, said Mr. Freeman, was a message of immediate possibilities in store for the industry in the development of power business. It was also interesting to note, said Mr. Freeman, that to-day there is an appreciation on the part of the government of what the industry can and will do in the conservation of national resources. A very large part of the activities of the association in the last year were directly in coöperation with the government. Mr. Freeman said that he felt sure that the message would receive a very hearty response from the industry. He moved a hearty vote of thanks to Dr. Smith and of willingness of the association to coöperate along the lines proposed.

In seconding the resolution, John F. Gilchrist expressed full appreciation of what Dr. Smith had done in giving the address, which would do a world of good. It will give the industry new heart in going through what with many companies has been a period of great stress. Mr. Gilchrist saw an evidence in the address that the government and the general public are beginning to appreciate the position the public utilities occupy in the prosperity of the country. The public utilities are seeing the dignity of the position which they occupy as public utilities. Mr. Gilchrist said that the public utilities are the workhorses of the farm and no farmer ever thought of economy by starving his work team. The utilities must be allowed to acquire such strength and resources as will enable them to keep pace with the growth of this great country.

The motion was carried by a rising vote.

FOURTH GENERAL AND EXECUTIVE SESSION

Report of Lamps Committee—Election of Officers—Form of Annual Report to Commissions—Billings and Doherty Prizes

The first business at the fourth general and executive session on Thursday morning was the report of the committee on safety rules and accident prevention. This was divided into two parts. William C. L. Eglin presented the general report as chairman. The report of the sub-committee on accident prevention, Charles B. Scott, chairman, followed.

REPORT OF LAMP COMMITTEE

Frank W. Smith read the report of the lamp committee, of which he is chairman.

Statistical information on lamps sales and development formed a very interesting part of the written report presented by the lamp committee, of which F. W. Smith was chairman, but the committee considers that the lamp exhibit afforded at Atlantic City was its principal work. Comments on industrial lighting codes, company lamp policies and new avenues of lamp distribution were also included in the report.

According to the report, the total sales of incandescent lamps for domestic use (excluding miniatures) amounted to 186,000,000 in 1918, of which nearly 90 per cent were tungsten-filament lamps and the rest carbon and "gem." About 24,000,000 units were of the gas-filled type. Since the last report of the committee the demand for gem lamps has ceased, and about the first of this year the manufacturers discontinued entirely their production so that no gem lamps are now available. The use of carbon lamps (excluding "gem" lamps) still seems to be confined to places where service is severe, where their use is temporary or where protection from theft cannot be afforded.

More than 82 per cent of all lamps sold during 1918 were of the 110-125 volt group, and nearly 75 per cent of these lamps were of the three standard voltages which have been heretofore recommended—namely, 110, 115 and 120—so that it is apparent that much has been accomplished along the line of voltage standardization.

The average candlepower of all lamps sold during 1918 was 51.5 cp., the average wattage 52.7, and the average lumens per watt 10.3 (more than three times that of 1907, when the tungsten lamps were first introduced). Of the vacuum-type tungsten lamps the 40-watt, 25-watt and 60-watt rank in popularity in the order named. Of the gas-filled multiple lamps the 100-watt, 75-watt and 200-watt rank in the order named. While lamps of this type of the voltage group given show but 13.4 per cent in numbers of lamps, the wattage output is 36 per cent; that is, over one-third of the wattage of the 110-125 volt lamps sold during the year were of the gas-filled type.

During the year the average candlepower of street series tungsten lamps was 157 cp., a decrease of nearly 2 per cent over 1917, due to the lesser number of 400-cp. and 600-cp. lamps used. Excluding the 250-cp. and higher-candlepower lamps, which are largely used in place of carbon-arc lamps, the average candlepower in 1918 was 74 cp., an increase of nearly 3 per cent.

About the only developments in lamps during the war were the introduction of the mill-type vacuum tungsten lamp, the reduction in number of sizes of bulbs and the production of motion-picture projector lamps.

The change in policy of companies handling lamps is given in the table on page 1081, based on reports that were secured from 50 per cent of the N. E. L. A. membership.

Discussion

This report was discussed by John Howell, L. A. Ferguson, R. H. Ballard, W. H. Johnson, Arthur Williams, Mr. Cushing, M. S. Seelman, Jr., and, in closing, Frank W. Smith. Mr. Ferguson strongly favored the continuance of the policy followed by the Commonwealth Edison Company, Chicago, of handling the renewal of lamps as the main point of contact with customers rather than letting this pass to other branches of the industry which, he said, want to make a profit out of the central-station customers. Mr. Williams explained the New York Edison Company policy, saying that probably 1000 distinct electrical centers have been built up in New York City where customers can buy standard tungsten lamps. In the next two or three years, he added, the largest growth will come from home de-

vices and the substition of central-station for isolated-plant service.

In connection with the lamp committee report President Wells read telegrams from John W. Lieb, acknowledging the greetings of the association and saying that he is on the "high road to recovery."

ELECTION OF OFFICERS

L. A. Ferguson, chairman of the nominating committee, presented the report of that committee. Its nominees were: President, R. H. Ballard, Southern California Edison Company; first vice-president, Martin J. Insull, Middle West Utilities Company; second vice-president, M. R. Bump; third vice-president, Frank W. Smith, United Electric Light & Power Company, New York; fourth vice-president, Walter H. Johnson, Philadelphia Electric Company; treasurer, H. C. Abell, American Light & Traction Company; members of the executive committee to serve three years: W. H. Atkins, Edison Electric Illuminating Company, Boston; P. G. Gossler, A. B. Leach & Company, New York; D. H. McDougall, Toronto Power Company, Ltd.; member of executive committee to serve two years, R. J. McClelland, Electric Bond & Share Company. The secretary was instructed to cast one ballot for the nominees, and they were declared duly elected.

CENTRAL-STATION COMPANIES REPORTING VARIOUS LAMP POLICIES

(Figures indicate per cent of companies reporting in each group)

Company Lamp Policy	Number of Lighting Consumers Supplied — Less than 1000		1001 to 5000		5001 to 10,000		10,001 to 50,000		Over 50,000		Total	
	1917	1919	1917	1919	1917	1919	1917	1919	1917	1919	1917	1919
Free renewals only	0	0	0	1	2	0	2	0	0	6	1	1
Merchandise only	85	80	63	80	32	83	32	71	17	59	63	79
Free renewals and merchandise	12	2	31	9	56	11	56	13	66	35	30	8
Do not handle lamps	3	18	6	10	6	6	6	16	0	0	5	12
Give renewals — make lamp service charge	0	0	0	0	4	0	4	0	17	0	1	0
Total	100	100	100	100	100	100	100	100	100	100	100	100

Mr. Edgar and Mr. Williams escorted Mr. Ballard to the chair, and the president from California received a most cordial greeting from the delegates.

Expressing himself as deeply grateful for the honor, Mr. Ballard said that he was not unmindful of the fact that his election was a tribute to the Pacific Coast and an expression of a real desire for a united industry in one common purpose, service to the public. It should be service satisfactory in every point of contact with the public, service even before profits. Mr. Ballard also expressed the hope that affairs would so shape themselves that all members of the association would feel that it would be profitable for the next convention to go to Southern California.

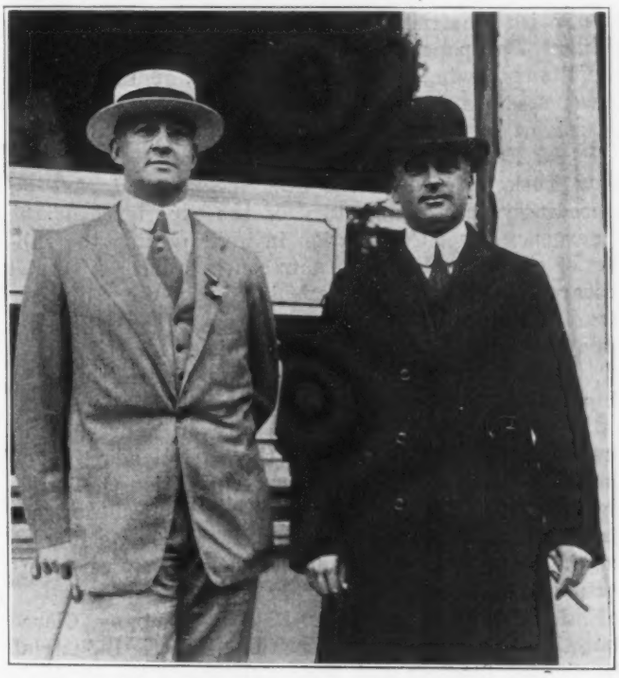
PRESIDENT-ELECT BALLARD

R. H. Ballard, the newly elected president of the N. E. L. A., is vice-president of the Southern California Edison Company, at Los Angeles, Cal. Mr. Ballard was born at Hamilton, Ontario, in 1875, and when a boy of fifteen entered the employ of the Thomson-Houston Electric Company at Chicago. In 1894 he went to Schenectady on the consolidation of the Chicago with the General Electric Company. There he was employed in the treasury department. In 1897 he left the General Electric Company to enter the employ of the West Side Lighting Company at Los Angeles as bookkeeper. Three years later he became cashier and office manager of the Butte (Mont.) Electric & Power Company, where he remained until 1904, when he returned to Los Angeles to accept a position as auditor of the predecessor of the Edison Electric Company. Since then he has passed through successive stages to the position he now holds with the Southern California Edison Company. Mr. Ballard is one of the leading figures in Pacific Coast utility work and was the first president of the Pacific Coast Section of the N. E. L. A.

IMPORTANCE OF ELECTROCHEMISTRY

Prof. Joseph W. Richards, Lehigh University, secretary of the American Electrochemical Society, then made an address on "The Importance of Electrochemistry." Professor Richards was given close attention as he outlined the large scope and purpose of the electrochemical industries.

In moving a vote of thanks, which the delegates passed by rising, E. W. Lloyd said that member companies should give much more consideration to the electrochemical industries than in the past. T. E. Bibbins, chairman committee on memorials, read the report of that committee.



J. E. DAVIDSON, PRESIDENT NEBRASKA SECTION, AND MAJOR D. S. MICHELSON, CHICAGO

A. S. Loizeaux, chairman, read the report of the committee on the Billings and Doherty prizes. The awards were: Doherty prize, "Distribution Engineering Economics," G. M. Armbrust, Commonwealth Edison Section; Billings prize, "Inspection Engineering," A. F. Bronwell, Commonwealth Edison Section; honorable mention, "Methods of Cooling Transformers," V. E. Alden, Baltimore Gas & Electric Company Section.

Charles L. Edgar read the report of the committee on the president's address. It directed the special attention of companies to the features of the address of

Mr. Wells. In presenting the report Mr. Edgar also recommended that the executive committee be directed to take up the question of combating the menace of socialism. This was approved by the convention.

Arthur Williams moved that the president be requested to appoint a committee to consider the question of what is ethical and just in the relations of the companies with labor for the guidance of the industry. He urged that if possible Mr. Edgar be enlisted to take an active part in this. William C. L. Eglin, in seconding the motion, asked that the entire broad scope of labor relations be considered, together with methods of profit sharing. The motion was adopted.

Arthur Williams then presented the usual resolutions of appreciation to those who had helped in the convention activities.

POWER SALES BUREAU AND COMPANY SECTIONS' MEETINGS

Investigation of Electric Welding by Emergency Fleet Corporation—Problems of the Local Company Section

More than 125 members of the Power Sales Bureau gathered Wednesday night in the Rose Room at the Hotel Traymore for the annual banquet of the power man, with Chairman G. H. Jones, Philadelphia, presiding. Two papers were scheduled for presentation at the dinner owing to the curtailment of the regular power sessions, instead of the formal addresses characteristic of former years.

F. M. Farmer of the Electric Testing Laboratories, New York, introduced the first speaker and gave an exceedingly interesting story of the experience of the Emergency Fleet Corporation in investigating the subject of electric welding for ship construction. A special research committee was appointed by the Shipping Board to study electric arc welding processes in the hope that it might develop opportunities for the saving of time and increase of strength over riveted joints in ship hulls. The armistice was signed before this committee completed its work, but already approval had been secured from Lloyds for the partial adoption of electric welding in shipbuilding. In addition the building of an electrically welded ship had been authorized. Mr. Farmer discussed the future of electric welding at length and predicted the development of a very important load.

E. J. Bartlett of the Baker R. & L. Company, Cleveland, then presented a paper entitled "Electric Industrial Trucks and Tractors and Their Relation to the Central-Station Load," in which the author dwelt at length on the opportunities ahead of central stations in promoting storage-battery transportation.

COMPANY SECTIONS' DINNER

Two past-presidents of the N. E. L. A., Henry L. Doherty, the originator of the company section idea, and William C. L. Eglin, who put the Doherty plan into effect, delivered addresses at the section's dinner Wednesday night. The gathering was under the auspices of the committee on company sections, and its chairman, F. A. Birch of the Philadelphia Electric Company, presided. There were about fifty present, including chairmen of company sections from every state of the Union. These men had come to discuss with the sections committee and with the officers of the association the problems of industrial sections and the broader questions which affect them all. This dinner was to bring all those interested together informally for an interchange of ideas, and it served its purpose well. Joseph B. McCall, president of the Philadelphia Electric Company and past-president of the N. E. L. A., could not be present, but he sent a message in which he said: "I am convinced that in coming years our executives and the leaders in our industry must of necessity come through the avenue of the local company section of the N. E. L. A."

POWER SALES BUREAU MEETING

About 100 delegates attended a meeting of the Power Sales Bureau Wednesday afternoon at the Hotel Traymore and discussed the effect of the war upon isolated-plant costs, electric furnaces and power factors in customers' installations. I. Lundgaard, Rochester, N. Y.; N. T. Wilcox, Keokuk, Iowa,; Morse Dell Plain, Hammond, Ind., and R. H. Knowlton, Philadelphia, led the discussions. It was brought out by data from the field that the isolated plant has been hard hit by the war as to increasing costs, and that the time was never better to secure this class of business. The growing usefulness of the electric furnace was also emphasized and the superior quality of its products reiterated. Development is proceeding toward the standardization of furnace practice to insure increased reliability of linings, and recently equipment for the use of smaller foundries has been placed on the market. The intensive use of electric furnaces at Detroit was also featured in the discussion. Power-factor improvement was discussed at length from both theoretical and practical angles.

SECTION PROCEEDINGS

Features of Technical, Commercial, Electric Vehicle and Accounting Sessions

In his opening address before the Technical and Hydroelectric Section, Chairman R. J. McClelland expressed the opinion that the engineer is the best-equipped man in the world to handle economic, political and industrial problems, because he has been imbued with the necessity of analyzing actual facts and has learned by experience that if conclusions are not based on definite considerations and physical facts the results may be of far-reaching seriousness. If engineers have not received recognized confidence of financial men so far, it is because some very few individuals have brought discredit upon the whole profession by recommending operations and undertakings which are commercially unsound. However, this objection can be removed if all will more closely consider the financial side of problems in the future. In this connection it is a hopeful sign that engineers are now more prominent in public, civic and administrative positions. More can be done if local sections of the N. E. L. A. will make a determined effort to induce broader study of economic and political situations.

The first session of the Technical Section opened promptly at 2 p.m. Tuesday, with Chairman R. J. McClelland presiding, and adjourned at 5.30. The interest displayed by all those who discussed the report of the committee on prime movers, which was the only topic of the afternoon, was in keeping with the vast amount of information which that report contained in its 160

pages. The committee in arranging the material in its report took up steam turbines first and proceeded to the coal pile, dealing in separate steps with the intervening apparatus. Mr. N. A. Carle, chairman of the committee, outlined the work done during the year and the plan followed in preparing its report, which was read in abstract only so as to allow a maximum amount of time for discussing it.

R. H. Ballard and Thomas Sproule presided at the second session, at which the principal topics of discussion were construction of underground and overhead lines. Inductive interference and joint use of poles were two timely topics covered.

About 200 were present at the third technical session Wednesday afternoon, the interest remaining high enough up to 6 p.m. to necessitate a number of those present standing throughout the meeting for lack of seats. Two reports were submitted for discussion—electrical apparatus, by R. F. Schuchardt, and meters, by F. V. Magalhaes.

At the close of the session a unanimous ballot was cast for the following officers of the Technical and Hydroelectric Section for the coming year: Chairman, I. E. Moultrop; vice-chairmen, N. A. Carle and A. H. Lawton, and executive committee, R. F. Schuchardt.

VEHICLE SESSIONS

Gas cars and animals are still widely used for transportation purposes, because the public has not yet accepted the facts about the electric vehicle which electric men know to be true. Chairman E. S. Mansfield referred to this condition in his opening address, analyzing conditions which might be expected to influence the future progress of the industry. An investigation revealed that the numbers of service stations and garages should be increased. There are insufficient to care for machines after they become the property of the public. Either independent transportation engineers of high class should be induced to study the problems of prospective customers who are willing for them to do so or else the manufacturers should add such experts to their selling forces. A certain amount of publicity is also necessary and a campaign of simple, direct and conclusive elucidation should be engaged in.

Mr. Mansfield pointed out that if the electric vehicle is to fill the sphere of greatest usefulness central stations and manufacturers must work together in full accord. The manufacturer must be allowed to design and construct unhampered; he must be the judge of the selling price; he should be willing to increase his plant capacity to permit of quantity production, and while relying on the central stations for moral support should not expect the central station to use electric cars where they will not meet with success.

The papers presented at the two sessions dealt with the operating experiences of the buyer and the merchandising problems of the seller of electric vehicles. Trucks were discussed more than pleasure cars, but industrial tractors were also considered at length.

For the coming year officers for the Vehicle Section were elected as follows: Chairman, George B. Foster, Commonwealth Edison Company, Chicago; vice-chairman, Frank W. Frueauff, Henry L. Doherty Company, New York; treasurer, H. M. Edwards, New York Edison Company; secretary, A. Jackson Marshall, New York. The new executive committee for this section, to serve for a period of three years, is made up of Walter A. Johnson, Philadelphia Electric Company; Frank W. Smith, New York; E. H. Mansfield, Boston, and C. K. Chapin, Memphis, Tenn.

ACCOUNTING SESSIONS

Paul R. Jones, vice-chairman of the Accounting Section, in opening his address at the first accounting session, held in the Million-Dollar Pier Tuesday, urged closer coöperation between the Accounting Section and the other sections of the association. Such coöperation is necessary, he said, if the section is to achieve the best results, and for this purpose he suggested that an invitation be extended by the Accounting Section to all other sections to appoint a member to each of the accounting committees. If this policy could be inaugurated, and the other sections coöperated, he thought closer unity would be obtained between the operators and accountants, and solutions to problems could be arrived at from a broader viewpoint.

Mr. Jones further suggested that to avoid duplication of work the chairman of the Accounting Section of each state or geographical section be invited to become a member ex officio of the executive committee of the Accounting Section.

In this way the accounting problems of each state could be presented more readily and difference of ideas on principle in a measure eliminated. In the speaker's opinion the preparation of the yearly budget should be in the hands of the treasurer of the section for submission by the chairman to the executive committee. The formation of two additional committees, one to make a thorough study of credit and collection departments and one to deal with such accounting questions as affect public policy, was also recommended.

Mr. Jones emphasized the need for all member companies to insist upon the personnel of their accounting organizations taking an active interest in the section's affairs. If the best results are to be obtained, the work should not be left to a comparatively few to do.

The second and closing accounting session opened with the report of the committee on operating records, C. A. White, Boston, chairman, followed by a paper on operations of the Motor Transport Corps, a report on purchasing and storeroom accounting and the establishment and growth of the ordnance finance section.

COMMERCIAL SESSIONS

The activities of the Commercial Section were brought before the convention in a series of five sessions, so great was the interest in this phase of central station business. It was pointed out that electric lighting of all kinds should now go forward since all forms of curtailment have been abandoned. The greatest prospects, however, appear to lie in the development of electric furnace loads, particularly for steel making. Electric ranges, it was said, would soon come into general use, following a vigorous campaign of education. The training of salesmen and their equipment with the necessary data was also given considerable attention.

The Commercial Section will be guided, during the next year, by John G. Learned, Public Service Company of Northern Illinois, Chicago, who has been elected chairman. M. S. Seelman, Brooklyn Edison Company, and Henry Harris, Wilmerding, Pa., were elected vice-chairmen, and R. H. Tillman, Consoliated Gas, Electric Light & Power Company, of Baltimore, is the new secretary.

TECHNICAL SECTION

Advisability of going to still larger turbines, cable rating and testing of instrument transformers were given careful consideration by this section.

THE entire first technical session was devoted to the 160-page report of the committee on prime movers. Comments were made on the different sections of the report, taking up steam turbines first and proceeding to the coal pile, dealing with the intervening apparatus and the problems of operation associated therewith. Unusual interest was taken in this session as indicated by the fact that every available seat in the meeting room was filled until the close of the session.

At the second session two important reports were presented. The first was the report of the committee on underground construction and electrolysis, and the second report was that of the committee on overhead lines and inductive interference. Those who discussed the subject considered relations with the telephone companies of first importance, especially in the matter of joint use of poles and the disposition of overhead lines to prevent disturbances in the telephone circuits.

Standardization of transformer polarity, establishing a proper basis for rating oil switches and extinguishing generator fires were among the principal subjects of interest at the third and last technical session. Marked attention was also given to methods of training metermen, the applicability of the Warren timing device, accuracy of current transformers and fusing of potential transformers. Both manufacturers and users of equipment showed by their expressions of opinion that they fully recognize the value of coöperating in developing new equipment and correcting present designs that may not be giving the best service.

TENDENCIES IN USE OF PRIME MOVERS

Steam, Water and Gas Power Considered—Progress in Development—Relation of Size of Units to System—Storage and Handling of Fuels

The discussion of the report of the committee on prime movers, which will be found on pages 1106-1109, was opened by W. L. Abbott, Chicago, who pointed out that, although there has been considerable concern regarding the operation of large turbines, there is nothing in the situation that warrants distrust in large turbine units or in the present design of these machines. Troubles have not been confined to any one feature, and the corrective measures which are being applied make it possible to contemplate with confidence even larger turbines than have been used in the past.

H. M. Cushing, Buffalo, N. Y., stated that out of 2780 machine days the turbines in the new station of the Buffalo General Electric Company were out of service only 260 days. Most of the difficulties have been due to high temperatures ranging from 650 deg. to 700 deg. Fahr.

W. S. Finlay, Jr., Interborough Rapid Transit Company, New York, commented on the operation of the large turbines in the company's Seventy-fourth Street station, details of which were given by him in the May 10 issue of the ELECTRICAL WORLD. In this station, he said, there is a maximum installed rating of all generating equipment of 190,000 kw. and in the Fifty-ninth Street station 210,000 kw. These stations operate in parallel.

Because the details of operation have been worked out on a careful basis, considering all the conditions which are met, all units now in operation have made a creditable showing. The generating system is now laid out on the basis of a 30,000-kw. unit and operating conditions and connections are such that 15,000 kw. is floating on the lines and available at all times, so that a 30,000-kw. unit can be taken out at any time without a disturbance in plant operation. Mr. Finlay agreed with the other speakers that improvements now being made point toward better turbine performance in available designs.

Philip Torchio, New York, explained the conditions of speed and size taken into consideration in the design of turbines and pointed out that, although certain designs do not lend themselves to high speeds, this does not mean that they cannot be satisfactorily built. He referred to the work of the power station committee of the A. I. E. E. and to papers which will be presented on turbine design at meetings in the coming fall.

E. H. Sniffen, East Pittsburgh, Pa., expressed the need for more coöperation between manufacturers and operators and between manufacturers themselves in order to establish design standards for turbines in the same way as already worked out for electrical apparatus through the A. I. E. E.

Higher Steam Pressures.—On the subject of boiler operation the different speakers seemed to agree that higher pressures must come at an early date. Richard H. Rice, West Lynn, Mass., suggested the construction of a plant with a rating of 2000 to 3000 kw., which might be operated with a steam pressure at 500 lb. to 600 lb., so as to determine the practical limitations and the needed developments in design for higher pressures. He pointed out that results secured with pressures of 250 lb. to 300 lb. have been successful with only slight changes in layout of power-plant equipment.

A. L. Meyer stated that by the use of low-carbon high-tension steels a boilermaker can now construct a boiler for pressures beyond 350 lb. He mentioned the construction of boilers in England in which steel with a tensile strength of 74,000 lb. per square inch is used.

I. E. Moultrop, Boston, said higher steam pressures seem to be the most feasible method of combating higher coal and labor costs.

Percy C. Idell, New York, in commenting upon tendencies in boiler construction stated that particular attention is now being given to ventilated walls. Manufacturers are working on steam pressure problems outlined by the committee and already have installations operating satisfactorily at 350 lb. per square inch pressure and many at 200 lb.

Robert Wyld, New York City, in commenting upon the subject of superheaters covered by the report, stated

that the superheater is a good indicator of the condition of the boiler. In case the boiler throws over solid material the trouble should be corrected at its source. John Primrose, New York City, added that in furnishing a superheater it is important to know the type of fuel, how it will be burned and the operating conditions on the boiler. He stated that the Power Specialty Company is working on a surface for superheaters that makes use of radiant heat.

O. F. Junggren, Schenectady, N. Y., said that superheating of steam is not as advisable as going to higher pressures, pointing out that the greatest economy is in the pressure and not in the temperature increase.

H. Herlan, Boston, referred to experiments which are being started and are expected to lead to results that will strengthen economizer construction and increase both transmission rates and scraper rates. Present scraper troubles he said are due mainly to inattention and pitting and ruptures, in many cases to chemical action resulting from the coal used, especially when high in sulphur. In one case where coal high in sulphur is used the company is trying a process of dipping the moving parts in a silica solution. A much harder iron is also being tried. W. S. Messler, Beacon, N. Y., in commenting on economizer operation stated that installations are now in satisfactory operation on 350-lb. pressure.

Stokers and Grates.—On that part of the report dealing with stokers and grates the following offered comments: H. M. Cushing, Buffalo, N. Y.; C. B. Grady, New York; T. A. Marsh, E. B. Ricketts, New York, and John Dallas, Philadelphia. The last speaker mentioned interesting results secured by means of waterbacks installed to help out in troubles with clinker grinders and to utilize heat for raising the temperature of feed water. Mr. Dallas stated that with long water backs from 4 to 5 per cent of the heat generated in the furnace was absorbed by the water passing through the waterbacks. With short waterbacks this rate of heat transmission was reduced approximately 60 per cent.

Burning Powdered Fuel.—Chairman McClelland outlined in some detail developments by a Seattle company in burning powdered fuel. He pointed out that the burning of the fuel is now perfectly practicable. The greatest problem is in the powdering and the grinding of the fuel. This fuel is delivered in closed tank cars and closed wagon tanks at a cost of about $7 per ton. A charge of about $1.50 per ton is made for powdering and grinding the coal.

W. S. Finlay, Jr., Interborough Rapid Transit Company, New York City, described a special induced fan which is now being used to take care of cinders. By this means he has been able to eliminate 70 per cent of the cinders from gases.

W. L. Abbott, Chicago, described a device which is being tested at the University of Purdue to burn ground coal rather than pulverized coal. This device is made up with a circular furnace arranged so that the coal can be fed in tangentially and burned while it is whirling on the inner surface of the circular furnace. The ash melts and runs out at the bottom. This device burns about 3000 lb. of coal per hour and it is said to operate at high efficiency. Following his remarks on this subject, Mr. Abbott took up at considerable length the details under which he has found it possible to store coal out of doors without the customary troubles from fires. He pointed out that it is essential that all fine and coarse coal be evenly distributed on a storage pile so that circulation of air may be cut off and combustion prevented. He referred to outdoor storage of coal in piles which had remained untouched as long as eight years without any evidence of heating.

The burning of lignite was discussed at considerable length by S. B. Flagg, Philadelphia, and T. A. Marsh, Chicago, Ill.

An interesting discussion was contributed by G. J. Foran, New York City, on the subject of ejectors and vacuum pumps. He referred to examples outlined in the report of the committee and compared the use of ejectors with vacuum pumps using the data furnished.

E. B. Ricketts, New York, recommended the use of standard boiler and turbine room instruments but emphasized the need of attention by men familiar with their operation.

OIL SWITCH GUARANTEES AND GENERATOR FIRES

Transformer Practice and Standardization as Well as Substation Practice Discussed by Electrical Apparatus Committee

While the electrical apparatus report, presented by A. H. Lawton of Jackson, Mich., digested quite fully on pages 1100 to 1105, covered a variety of subjects, the discussions in which the greatest number participated centered around standardization of transformer polarity, construction of substations which can be easily enlarged, automatic substations, difficulties with oil and airbreak switches, basis for oil-switch guarantees, and protection of generators against internal troubles. In these discussions, as in all the others, the value of coöperating with manufacturers to acquaint them with operating troubles and performance was continually emphasized.

Difference of opinion regarding the advisability of standardizing transformer polarity existed, some saying that subtractive polarity should not be adopted for distribution transformers, while others sided with the committee report by upholding such standardization. On the motion of H. B. Gear, Chicago, the subject was referred back to the sub-committee for further consideration.

Too many outdoor substations are constructed so they cannot be easily extended, said J. C. Martin, Allentown, Pa., thus requiring the rebuilding of stations when they outgrow their load. Where this is true it is due to lack of imagination regarding future growth, contended R. J. McClelland, New York. One company's way of avoiding this objection was fully explained in the ELECTRICAL WORLD recently, remarked H. L. Wallau, Cleveland. R. J. Wensley, Pittsburgh, referred to the use of automatic substations for serving three-wire loads as a means of saving investment in large feeders.

Various topics regarding oil and air-break switches were touched on, such as the disadvantages of alternating-current control of oil switches, moisture entering outdoor switches, oxidation of air-break switches under heavy load, etc. While some persons contended that the duty on which oil switch performance is guaranteed does not approach the severity of actual practice, Mr. Smith of Schenectady said that it is only a bench mark on which to base ratings. A. S. Loizeaux, Baltimore, suggested that oil-switch explosions are sometimes due to explosion of oil fumes, in which case they may be

prevented by proper scavenging of the air, one method being described. This involved the use of two large check valves, one at oil level and one at top of case to permit air circulation. Compilation of information regarding performance and breakdown of apparatus with attending conditions was particularly encouraged by Mr. Smith.

Generator Fires.—The subject of extinguishing fires in generators was a very lively one, the use of steam or water or both being advocated for this purpose, although preference was shown for water. H. R. Summerhayes, Schenectady, said that immersion of armature coils in water if not prolonged is not permanently injurious, but they should be dried as soon as possible.

Aside from those already mentioned, the following took part in the discussion: G. F. Morrison, A. S. Albrecht, Detroit; A. A. Meyer, Detroit; N. L. Pollard, Newark, N. J.; Mr. McNeil, Pittsburgh; H. B. Pope, Brooklyn; W. L. Abbott, Chicago; C. I. Crippen, Youngstown, Ohio, and N. H. Stahl, Pittsburgh.

UNDERGROUND CONSTRUCTION AND ELECTROLYSIS

Rating of Cables, Dielectric Loss in Mineral and Rosin Oil Compounds, Causes and Location of Cable Failures and Ventilation of Manholes

Underground construction is discussed under fourteen headings in the report of the committee of which E. B. Meyer is chairman, carrying capacity of cables, dielectric losses and cable failure being treated most extensively. Among other subjects covered are fault location, fireproofing of cables, selection of duct size, installation of subway transformers, joint-filling compounds, three-wire and street-lighting circuits, junking of cable and transformer primary cut-outs.

The rating of cable should depend, says the committee, on the temperature actually obtained during operation. To facilitate determining this rating, operating companies are urged to keep accurate records of the load on their transmission cables, measurements of temperature and data on characteristics of the duct line.

One company has developed a plan by which the cable is given a seasonal rating based on the average temperature of an idle duct (see Fig. 1). Another company reports that the temperature of a bad local hot spot in a duct line was reduced from about 160 deg. Fahr. (71 deg. C.) to about 75 deg. Fahr. (24 deg. C.) by uncovering the conduit line for a distance of about 20 ft. (6 in.) and backfilling the excavation with heavy clay to replace the sandy fill which had been causing the trouble. Where local conditions do not permit the use of this method a specially ventilated manhole may be installed at the point where the temperature is excessive.

RELATIVE VALUES OF ROSIN AND MINERAL OILS, AS DETERMINED BY THE COMPANY

(See accompanying curves also)

Dielectric Leakage Current.—At 25 cycles and 20 deg. C., was more than twice as great in cables using rosin oil as in those using mineral compounds, and at 100 deg. C. was over four times as great.

At 60 cycles and 20 deg. C., rosin oil was 25 per cent higher, and at 100 deg. C. about 130 per cent higher.

At both 25 and 60 cycles the current was only about 12 per cent higher at 100 deg. C. than at 20 deg. C. in the mineral compounds, while it increased over 100 per cent in the rosin-oil compounds.

In the rosin-oil compounds the leakage current was practically constant from 0 deg. to 60 deg. C., but above this critical temperature it increased very rapidly. The mineral compound showed practically a straight line increase through the whole temperature range.

Power Factor.—The power factor is slightly greater at 25 than at 60 cycles for all temperatures. It is less in the rosin cables for the lower temperatures, but above 40 deg. or 50 deg. C. is greater in the rosin cables than in the mineral oil cables.

Insulation Resistance.—The insulation resistance on direct-current test is uniformly less for the rosin compounds, and decreases for both compounds as the temperature increases, but while it falls to an extremely low value at 90 deg. C. for rosin compounds, it is still in the order of megohms for the mineral-oil compounds.

There seems little reason to doubt the superiority of a mineral-oil over a rosin-oil base as far as dielectric losses are concerned. However, some mineral-oil compounds might possibly become too fluid at high temperatures, leaving the insulating material dry in certain sections and thereby liable to breakdown. Until the results of additional investigations are available the committee is not prepared to give its unqualified approval to the use of mineral-oil compounds to the exclusion of all others.

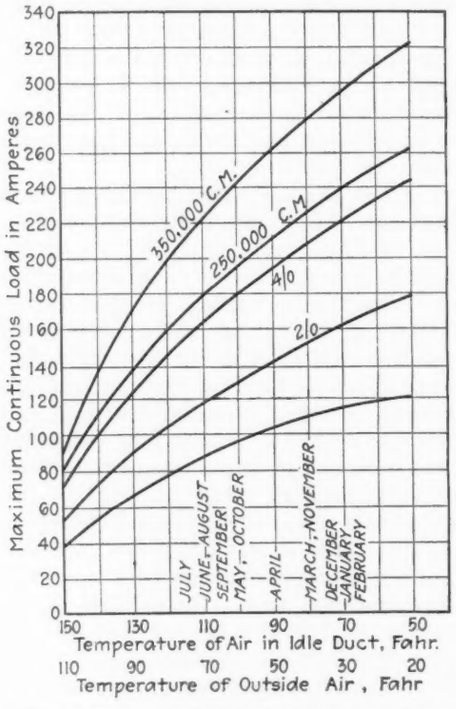


FIG. 1—EFFECT OF TEMPERATURE ON UNDERGROUND CABLE RATINGS

Graphic chart for determining the maximum continuous loading of 13,200-volt underground cables at different air temperatures. Maximum two-hour overload rating may be taken as 10 per cent above the continuous rating obtained from the curves. These tests were conducted by Public Service Electric Company.

It seems to be firmly established among member companies that cement is superior to the various types of asbestos covering used for fireproofing cables in manholes. However, there is a considerable difference of opinion regarding the comparative merits of rope and metal lath for reinforcing the cement covering. It is generally agreed, however, that the covered cable in the manhole has a better chance to radiate its heat than the uncovered cable in a conduit line.

The opinion was expressed that it is not desirable to concentrate more than 7000 kva. to 8000 kva. in a single underground circuit, and that 3-in. (7.6-cm.) (outside diameter) cable is about the largest now in use. The committee recommended that the size of a single conduit be limited to from sixteen to twenty ducts and repeated a previous recommendation that not more than 35,000 kva. be carried in a single-duct line.

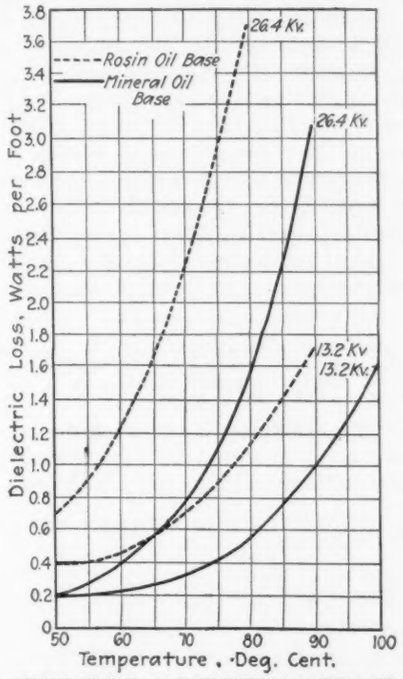


FIG. 2—COMPARISON OF DIELECTRIC LOSSES IN CABLES

The dielectric energy losses are shown for cables identical in size and construction, but one was impregnated with rosin oil and the other with mineral oil. The loss in the 26,400-volt rosin cable at 80 deg. C. is more than 2 watts per foot in excess of the loss in the mineral-oil cable. The tests were conducted on a 60-cycle circuit.

Statistics obtained from eight of the larger member companies show that subway-type transformers are being used in sizes of from 1 kva. to 150 kva. in manholes and vaults. The transformer rating per manhole is usually limited to 200 kva., reaching 300 kva. as a maximum. The amount of heat dissipated through the walls, roof and floor of a dry manhole varies from 3.7 watts to 4.8 watts per square foot (40 watts to 51.5 watts per sq.m.) with manhole air temperatures of from 100 deg. Fahr. to 120 deg. Fahr. (38 deg. C. to 49 deg. C.). Practically all companies use manholes with ventilating covers, and a few use standpipes to promote air circulation. The use of forced ventilation is not recommended except in extreme cases.

Some companies criticise severely the use of paraffin for filling high-tension joints, and other companies equally large and of as wide experience will use no other material. The disagreement, however, appears to be due not so much to the compounds as to the manner in which they are used.

To establish a neutral connection it is suggested that a tap from transformer windings be used at substations, etc., instead of balancer sets. This will reduce investment and operating cost. It is only necessary to have taps from two converter sets in each substation in order to insure continuity of service.

Since four companies operate satisfactorily with neutral mains having only 50 to 60 per cent the cross-section of one outside leg, it seems likely that the others could do so and thereby effect a considerable saving in cable cost.

In series underground street-lighting systems lead-covered rubber-insulated cable is used more extensively than paper-insulated cables for lamp connection. Three companies ground the lead sheath to the pole bases for safety of pedestrians while a few companies use insulating transformers with grounded secondaries to serve a few lamps in places.

The wasteful practice of selling mixed lots of junk by gross weight only, and not by the weight of the component parts, was condemned. Stripping machines have saved substantial amounts for companies which dispose of very large quantities of scrap yearly. Metal salvaged by this means brings about 80 per cent of the market price of new metal.

With one exception, all companies which have used the inclosed-fuse type of primary cut-outs report that this device is a failure in underground transformer installations. It was said that there is no inexpensive and satisfactory transformer primary cut-out on the market at the present time. The companies which have condemned the inclosed-fuse type of cut-out are experimenting with oil-immersed and other types of fuses. The development of a cheap and reliable primary cut-out offers an attractive field of endeavor for the inventor.

In discussing the committee report the members agreed that great advantages would result from further standardization of manhole and duct-line construction. Several members felt that the standard duct size might well be 4 in. or 4½ in. instead of 3½ in. This would facilitate changes and repairs. There is yet considerable difference of opinion regarding the relative merits of protecting cables in manholes with cement (over metal lath or rope) and disposing of them on shelves. R. O. Bentley, Newark, N. J., advocated more uniform spacing of manholes in the interest of reducing the number of cable lengths which must be kept on hand. J. B. Noe, New York, said that the practice of winding rope under the cement on cables in manholes had resulted in much damage to cables. The rope

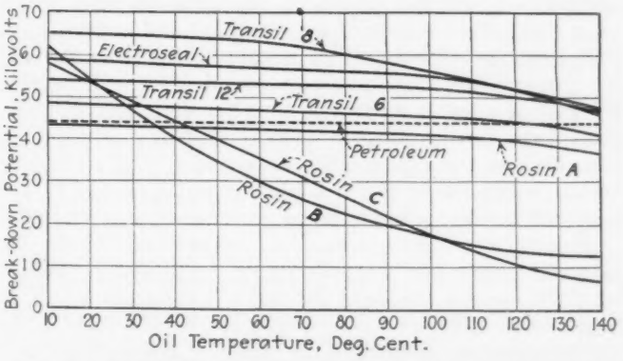


FIG. 3—DIELECTRIC STRENGTH OF ROSIN AND MINERAL OILS

The curves were plotted from tests conducted by one company. As a result of these tests the cable specifications of the company now require the use of either a mineral-oil compound or a compound containing less than 15 per cent of rosin oil.

soon burned away in case of fire and left space about the cable in which cable fires readily started. The use of metal lath, however, while facilitating the removal of cement for repairs, was not damaged by fire and thus protected cables adequately from external sources of trouble. J. W. Sylvester, Philadelphia, H. Goodwin, Schenectady, N. Y., and Messrs. Brundige, Wallau and La Due also took part in this discussion.

OVERHEAD LINES AND INDUCTIVE INTERFERENCE

Present Status of Important Problems and Future Policies in Connection Therewith—Joint Usage of Poles, and Insulator Deterioration

The greatest single activity concerning inductive interference has centered about the California joint committee order in the form of further technical studies and steps to improve the former rules, according to the committee on overhead lines and inductive interference (A. E. Silver chairman). This order, while framed in a coöperative spirit and indicating a better mutual understanding of the difficulties encountered, still appears to lack much of representing a satisfactory solution of the inductive interference problem. It does regulate the kind, arrangement and methods of operating power lines and apparatus, but relatively little attention is given to the corresponding conditions for telephone lines and apparatus or to the establishment of an equitable and economic balance between the corrective measures to be applied to the respective systems.

With the increasing use of the electric arc furnace, which tends to distort the wave form of the system from which it is supplied, another factor has been brought into the interference problem that will need serious consideration.

Clearly, the situation requires continued and increasing coöperative efforts between the interested parties, both in the way of engineering analysis to gain a better mutual understanding of the factors contributing to disturbances and in so laying out and coördinating any extensions of lines or equipment as to guard against objectionable disturbances. The indispensability of both classes of work makes such coördination doubly important, but in effecting it there is real danger of an undue share of the responsibility falling on the system which contributes the distributing influence—an influence, however, which is harmful to no other than the peculiarly sensitive telephone apparatus.

Joint use of poles by power and telephone companies is of much concern to the industry and public as a whole for reasons of conservation and convenience, and every reasonable effort should be made to further its general application along sound lines. However, prevailing telephone practice thus far definitely discourages extensive joint-pole usage, it being limited to circuits not exceeding 5000 volts and no suitable provision being made for the higher voltages which are required in the development of power-company business.

Among the many war-time suggestions made by manufacturers for the purpose of facilitating production was a new standard for cable stranding which is based upon utilizing a minimum number of strand sizes and designating each cable in terms of the number and diameter of strands composing it, rather than in terms of circular mils as at present. By doing this it is claimed that the problem of manufacturers' stocks will be much simplified and that the manufacturers, particularly those who do not draw their own wire, can make more prompt deliveries.

Insulator depreciation, particularly in higher voltage usage, is believed to take place at too rapid a rate, although so far as the committee has been able to learn there has been very little effort made during the war period to analyze the causes further. Therefore renewed activity in the form of comprehensive insulator analysis and research is greatly needed, particularly in connection with design and manufacture of insulators.

In the appendix of this report John B. Taylor discusses telephone disturbances by induction.

H. B. Gear of the Commonwealth Edison Company emphasized the need of expert advice in regard to inductive interference. He added that there should be some way of measuring noises induced in telephone circuits and that standards giving the amount of permissible noise should be established. A number of specific instances of inductive interference and solutions were given by B. E. Morrow, Jackson, Mich., and G. F. Morrison, New York City, F. D. Nims, Seattle, Wash., cited a case of interference with a telephone circuit 30 miles from the power circuit in the Puget Sound region. There appears to be no agreement as yet showing just what constitutes a parallel circuit. Paul Spencer, Philadelphia, gave an interesting account of relations with the telephone companies in Pennsylvania.

TESTING THE METERS AND TRAINING METERMEN

Instrument Transformer Test Practice and Performance, Fusing of Potential Transformers and Periodic Schedules for Meter Tests

Instrument-transformer performance and testing and an outline of several companies' methods of training meter testers are discussed very completely in the report presented by the committee on meters (F. V. Magalhaes chairman). In addition, recent developments in meter practice are mentioned, maximum demand meters being especially emphasized. In summarizing the results of the investigation on instrument test practice, the committee said that the manufacturers' laboratories and the commercial standardizing laboratories incline toward the use of primary test methods; whereas operating companies quite generally use methods in which a transformer is tested by comparison with a standard transformer that has previously been tested by a primary method.

Of the primary methods, the one most frequently used is the so-called shunt or potentiometer method. For potential-transformer tests by this method a non-inductive resistance of large value is connected across the primary of the transformer to be measured and the secondary voltage is balanced against the voltage drop across a portion of this resistance.

For current-transformer tests by this method a fixed non-inductive resistance is inserted in the primary circuit of the transformer under test and an adjustable non-inductive resistance is placed in the secondary. The test is made by adjusting the secondary resistance until a balance is obtained between the voltage drop across this resistance and across the primary resistance.

At least three different kinds of instruments are used to determine balance in the potentiometer or shunt method. The Bureau of Standards employs a vibration galvanometer—*i.e.*, a galvanometer sensitive to alternat-current—and the Electrical Testing Laboratories employ a direct-current galvanometer with a synchronous contactor in its circuit, the function of this contactor being to reverse in direction each half-cycle. The third kind of indicator reported was a separately excited dynamometer connected to a phase-shifting transformer.

One large manufacturing company reported the use of the mutual inductance method for testing current

transformers. This method resembles very closely the potentiometer method referred to, except that inductances are introduced in the primary and secondary respectively of the transformer under test, that for the secondary circuit being adjustable, and a balance is obtained for the voltage induced on the secondary of these inductances.

One operating company has developed a secondary method wherein comparison is made between a transformer under test and a standardized transformer of the same nominal ratio by measuring the vector difference in current or voltage on a separately excited dynamometer of high sensitivity. This method is inexpensive and affords an accuracy that is sufficiently high for all commercial purposes.

Discussing the practice of using potential transformer fuses with watt-hour meters, the committee reported that they are liable to be light and fragile, and the loss of a fuse would either mechanically or electrically cause the loss of the element of one phase. With an inductive load that particular phase might be carrying a relatively small percentage of the total load and the blown fuse thus remain undetected for a considerable period with a significant loss of revenue. Of the companies from which reports were received, 80 per cent use unfused potential transformers on circuits of 6600 volts or less. The suggested use of a limiting resistance in the primary in place of the fuses is of questionable value because of the possibility of introducing errors.

On account of war conditions central stations have had considerable trouble in maintaining a meter-testing force and increased efforts have been made to expedite the training of meter testers. Moreover, many companies had to resort to the exclusion, suspension or entire abandonment of various periodic schedules of testing and inspecting. In the report the committee gave in detail the methods used by several companies in training new men as testers. Mention was made too of the meter-testing course of the Iowa State University.

Education for Metermen.—Several delegates mentioned metermen's courses which their companies have based on their experience during the war, the opinion in general being that better results are obtained by training the men under an instructor and conducting reading courses and questions and answers than by allowing men to study under several men's guidance as is generally done. Such courses help considerably to weed out the misfits. Some spoke highly of the employment of women in meter laboratories, while others were not so commendatory. It was brought out that small companies are in need of a meter-testing service because they cannot perform it very economically.

All agreed on the importance of testing instrument transformers because revenue is so closely related thereto. Mr. Gibbs of Pittsburgh pointed out that aging has not been noticed with silicon steel now used in transformers, but it may be appreciable in older types not made of this material. Possibly line short circuits are more responsible for inaccuracy than aging, said C. H. Ingalls, Boston, while C. S. Van Dyke, Schenectady, contended that the change in accuracy of transformers that his company has used for thirteen years is not worth considering. Need of some testing method which is less cumbersome than the Bureau of Standards rotating-standard method was pointed out by W. H. Fellows of Washington, D. C.

The discussion regarding the Warren timing device related to the operation of the device, its applicability and desirability. The accuracy is very high compared with other timing devices, and the device can be easily applied wherever a clock mechanism has formerly been used. It has been found particularly effective where textile mills are being served, because maintenance of a uniform frequency prevents breakage of threads or reduction of output. However, it was brought out that operation of clocks from alternating-current sockets will necessitate the maintenance of more uniform frequency than is commercially necessary or required by most commissions.

Transformer Fuses.—Fusing of potential transformers is still an open question, some following this practice while others have found it more advantageous not to do so. Different voltage limits are set by companies above which fuses are used, 22,000 volts being the highest mentioned, this being at Youngstown, Ohio. In connection with this discussion it was brought out that protection of two kinds has to be considered—transformer protection and system protection.

The following men also took part in the discussion: W. L. Wadsworth, Minneapolis, Minn.; G. A. Schneider, Toledo; Warren Partridge, Clearfield, Pa.; J. J. Reilly, Philadelphia; L. M. Meckler, Newark, N. J.; S. G. Rhodes, New York; F. J. Murmann, Mount Vernon, N. Y.; H. J. Blakeslee, Hartford, Conn.; H. E. Warren, Ashland, Mass.; W. J. Mowbray, Providence, R. I.; J. H. Sturge, Newark, N. J., and C. A. Harrington, Youngstown, Ohio.

RATE AT WHICH METER INITIALLY CORRECT WOULD RUN IF CONNECTED TO SECONDARY OF CURRENT TRANSOFRMERS

	Type of Transformers				
	D-20	E-18	K-5	K-28 K-48	K-55
No. of transformers tested	62	40	54	83	149
Full Load:					
(a) Average accuracy	101.5	101.5	100.1	100.8	100.7
(b) Average deviation from (a)	0.4	0.2	0.1	0.1	0.2
(c) Maximum deviation from (a)	1.0	0.5	0.6	0.7	0.5
No. of transformers	62	40	54	83	149
10 per Cent Load:					
(d) Average accuracy	101.5	101.4	100.2	99.8	100.2
(e) Average deviation from (a)	0.6	0.3	0.4	0.3	0.2
(f) Maximum deviation from (d)	1.7	1.1	1.5	2.7	0.8
Power Factor 0.5 Full Rating Current:					
(g) Average accuracy	102.0	102.3	101.1	100.8	101.1
(h) Average deviation from (g)	0.7	0.6	0.5	0.4	0.5
(i) Maximum deviation from (g)	2.2	1.1	1.1	1.5	1.5

MAGNETIZATION OF CURRENT TRANSFORMERS

	% Current Rating	Form K28, %	Form K48, %	Form K65, %	Form W2 %	Form 3 %	Type KA, %	Type KB, %
Magnetization caused by opening secondary:								
Change in ratio	10	+0.41	+0.25	+0.12	+0.18	+0.17	+0.17	+0.16
Change in ratio	100	+0.24	+0.14	+0.10	+0.03	+0.14	+0.09	+0.10
Change in phase angle	10	+2′	+3′	+2′	+2′	+11′	+3′	+6′
Change in phase angle	100	+1′	+2′	+1′	+1′	+6′	+2′	+2′
Magnetization caused by current overload:								
Change in ratio	10	+0.22	+0.32	.....	.....	.....	+0.57	+0.54
Change in ratio	100	+0.08	+0.05	.....	.....	.....	+0.15	+0.15
Change in phase angle	10	+5′	+1′	.....	.....	.....	+12′	+8′
Change in phase angle	100	+2′	+1′	.....	.....	.....	+5′	+3′
Magnetization caused by passage of direct current:								
Change in ratio	10	+0.42	+0.22	.....	.....	.....	+0.47	+0.50
Change in ratio	100	+0.12	+0.09	.....	.....	.....	+0.19	+0.15
Change in phase angle	10	+11′	+4′	.....	.....	.....	+13′	+7′
Change in phase angle	100	+3′	+1′	.....	.....	.....	+4′	+4′

Magnetization due to an excessive current overload with the secondary closed, or due to the passage of direct current through the windings, is more severe than that caused by opening of the secondary in the load.

COMMERCIAL SECTION

Particular attention given to relations with customers, improvements in wiring devices, stimulation of store lighting and use of electric ranges and water heaters.

THE end of the war has been the signal for renewed activity on the part of the central-station men to secure all kinds of new lighting business, as brought out in papers and discussions in the Commercial Section. This is especially true of display and advertising lighting, curtailed during the war. In the interest of proper illumination for streets and highways it was proposed that the central station in each city install in a conspicuous locality one block of model street lighting, thus showing the citizens of each community the difference between good, bad and indifferent street lighting.

The use of the electric furnace for steel and brass making is rapidly increasing, and power salesmen are taking full advantage of the opportunity to press their advantage in this tremendous field for the sale of electrical energy. Range business which could not be supplied during the war should now be developed by an educational process for which both central station men and the manufacturers should be responsible.

It was said that in the Northwest, where hydroelectric energy is largely used, 75 per cent of the homes are equipped with electric ranges and water heaters.

A great deal of valuable information was brought out for the instruction of salesmen and technical data for their use in selling operations. The isolated plant was described as being "on its last legs."

STIMULATION OF LIGHTING BUSINESS

Opportune Time for Developing Lighting of All Kinds Has Arrived—Suggestions for Campaigns Are Included in Committee Report

Store lighting is of especial importance at the present time, in the view of the committee on this subject (A. L. Powell chairman), since it is in this field of lighting that increased business can be secured quickly and easily. For this reason campaigns of an educational nature, supplemented by local effort, should be conducted in the trade and the popular press to emphasize the relation between good lighting and sales.

From the lighting point of view stores can be divided into three classes—(1) the large department and dry-goods stores, which can usually afford to engage consulting illuminating engineers; (2) the distinctive shop in which individuality is the keynote (these should not be handled by the campaign method since it is the suggestion of artistic or novel methods of lighting which appeal to them most), and (3) small stores, which, though of little importance individually, are of great importance collectively and are best adapted to campaign treatment.

In a campaign directed at the latter the first step is to adopt one or two fixtures which can be obtained and stocked easily, to reduce the selling expense. Then a meeting should be called with local contractors to outline the campaign and decide on the price of wiring per outlet, terms of payment, method of financing, etc. This step can be followed by local advertising news stories on the value of good lighting, lantern-slide lectures before local merchant associations, mailing booklets to prospective customers, etc. It might be possible to standardize window-lighting outfits of metal molding having two, three or five sockets per strip which can be wired in advance. Stage-lighting effects can be used to advantage and color effects can be produced by varying the direction of the light. These can be studied with shadow boxes.

Norman Macbeth, New York; Leon Scherck, Poughkeepsie, N. Y., H. C. Sterling, Atlantic City; J. C. Disrael, Philadelphia; D. E. Peck, Schenectady; Joseph Becker, New York, and E. A. Mills, New York, discussed the paper.

STREET AND RESIDENCE LIGHTING

A plan for inviting all central stations to install a block of model street lighting was presented by C. E. Durfee, chairman of the committee on lighting of streets and highways. The aim was that there might be a conspicuous demonstration of modern lighting efficiency in every city. The need for better lighting on interurban highways for the encouragement of motor traffic was urged, and the development of farm load and factory sign load along these highways to help finance the extensions was recommended. Preston S. Millar, New York, W. D'Arcy Ryan, Schenectady, and Daniel Haggerty, Worcester, Mass., took part in the discussion. Mr. Ryan exhibited a number of interesting slides.

The average gross revenue from residence consumers continued on about an average basis during the past two years, according to the sub-committee on residence lighting (C. W. Johnson chairman). Active selling of electric merchandise and the elimination of empty sockets are the principal methods of keeping up this revenue.

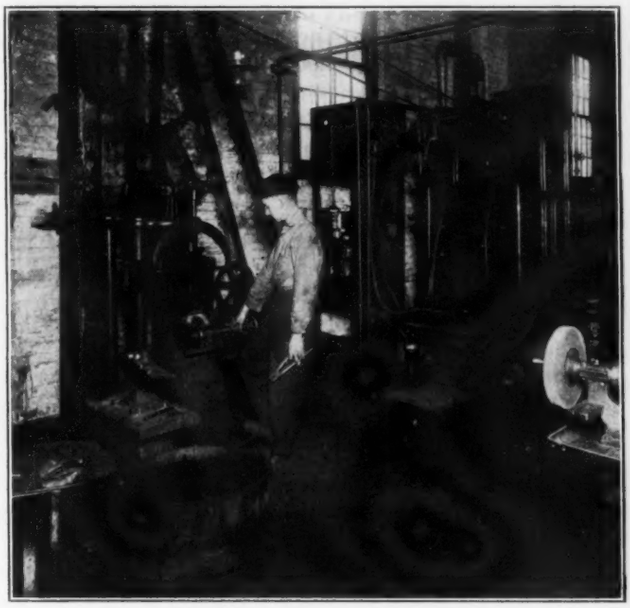
The average cost of securing old house-wiring contracts, including the expense of carrying the account, was approximately $5 per contract in 1916 and 1917. Under the stress of financial conditions it was deemed advisable by one company to make this soliciting cost a part of the contract price. By this plan the company in question expects to save approximately $20,000 during 1919.

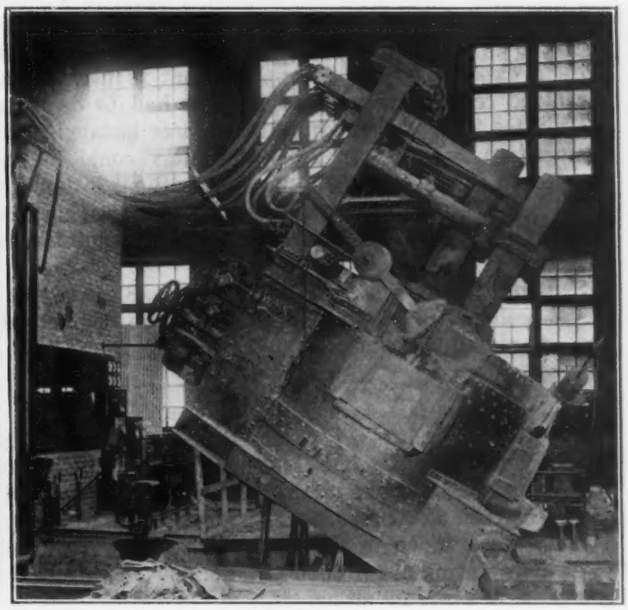
F. B. Pembleton, Newark, N. J.; L. D. Gibbs, Boston; C. G. Dufree, Rochester, N. Y.; G. H. Stickney, Harrison, N. J., and N. H. Boynton, Cleveland, discussed the paper.

The possibility of applying outdoor illumination to night work or recreation, monumental structures, pageants and festivals, flags and displays, is once more open. This load is not only desirable as a revenue producer, points out the committee on outdoor lighting (H. H. Magdsick chairman), but as a means of focusing attention on the subject of lighting and keeping it alive in the minds of the people. The extension of outdoor lighting will, no doubt, stimulate higher standards of intensity in commercial lighting installations.

Norman Macbeth, L. E. Brown, Niagara Falls; G. H. Stickney, and W. D'Arcy Ryan, Schenectady, took part in the discussion of this paper. Mr. Ryan exhibited slides of the jeweled-arch displays in New York and Chicago.

A marked interest was shown in the address given by William A. Durgin, Chicago, on Thursday on "Our Manufacturing By-product" during which he demonstrated the proper method for illuminating industrial plants. Mr. Durgin showed how correct lighting has affected production in a number of industrial plants where he has conducted tests. His tests were carried on at much higher illumination values than those proposed by the I. E. S. and showed that with a 5 per cent increased investment in lighting the plant production could be increased from 15 to 27 per cent.





ELECTRIC FURNACES, ELECTRIC WELDING AND OTHER COMMERCIAL APPLICATIONS OF ELECTRIC HEAT OFFER EXCELLENT FIELDS FOR POWER-SALES ACTIVITY *

Two fields for the extension of electrical advertising which present themselves at the present time were considered by the commitete on electrical advertising (E. A. Mills chairman)—signs, darkened by the edict of the Fuel Administration and still standing inoperative in front of their owners' establishments in some cases, and new signs or, more properly, new sign prospects.

Central stations and every other agency dealing in electrical advertising should encourage the sign owners to brighten up their old signs, install new lamps and take such measures generally as will add to the appearance of their signs.

With regard to new business, indications seem to point to a prosperous post-bellum period as soon as the various problems of reconstruction and reorganization have been solved. Factory advertising in the form of electric signs has not been considered extensively before, but is full of possibilities because it will help educate others to the use of electrical advertising.

Considerable discussion followed the presentation of this report, in which L. E. Brown, Niagara Falls; G. H. Stickney, and H. C. Sterling, Atlantic City, took part.

To help develop new lighting business, to improve existing lighting and to promote the satisfaction of present customers by giving them more effective lighting are the three commercial purposes of illuminating engineering in the central-station industry, according to the sub-committee on lighting of public buildings (J. Bertram Regar chairman). To help achieve these purposes the Commonwealth Edison Company of Chicago has just prepared a list of architects, builders and contractors to whom will be sent the schedule of rates of the company and information sheets on Edison service, information on modern methods of interior wiring, interior and exterior lighting, electric motor drive, etc.

For a similar purpose the Philadelphia Electric Company prepared a very attractive illustrated booklet on church lighting.

The paper was discussed by W. P. Blackwall, New York; Bassett Jones, New York; Joseph Stickney, Indianapolis,: and Joseph D. Disrael. Messrs. Jones and Stickney cited conspicuous cases of installations ruined by glare and emphasized the importance of immediate action in this field.

LAMP EQUIPMENT

Very few departures have been made during the last two years in the design of equipment to provide better and simpler means of controlling and redirecting light, according to the committee on commercial aspects of lamp equipment, (D. R. Hogue, chairman). The big problem has been to furnish the proper equipment for gas-filled lamps.

As a means of helping the introduction of good lighting central-station men should foster the movement to introduce electrically equipped furniture. Many houses and apartments were wired before the day of portable lamps, and in such places the wired furniture often fills a long-felt want.

The features of lighting equipment that have been brought out recently are described in this report.

This report was discussed by G. H. Stickney, Harrison, N. J., O. L. Johnson, Chicago and others.

*Photo on left supplied by Society for Electrical Development.

PROMOTION AND INCREASE OF POWER SALES

Effect of the War on Isolated Plants and Possibilities Afforded for Profitable Business in the Industrial Field

"The Effect of the War on Isolated-Plant Costs," as discussed by J. W. Meyer, Philadelphia, at the meeting of the Power Sales Bureau, appears in increased expenses and less satisfactory service. The author described the inability of the isolated plant to take advantage of cyclical price reductions and pointed out the difficulties of securing high-class attendance under present economic conditions. Examples were given of coal cost advances and operating expense increases, with data as to the competitive rates necessary to meet former and present expense levels. It appears that in five typical cases the central stations would have had to decrease their rates 22.2 per cent in 1916 to meet isolated-plant competition, whereas in 1918 the rates could be increased on the average 37.3 per cent without losing the business. The conclusion seemed irresistible that the isolated plant's days are numbered, in the opinion of the author.

S. Bennis, New York; R. H. Knowlton, Philadelphia; M. S. Seelman, Brooklyn, and M. Dell Plain, Hammond, Ind., discussed the paper.

ELECTRIC FURNACES

Col. C. F. Hirshfeld, Detroit, gave a résumé of the 1917 report of the Electric Heating Bureau on "Electric Heating of Non-ferrous Metals." J. D. Noyes, Detroit, then described electric furnace applications in that city. Twenty were added to the Detroit Edison system last year, aggregating about 6000 kw., and 2000 kw. in brass furnaces is now on order. About 12,000,000 kw.-hr. were sold in 1918 at Detroit for furnace service, and two or three times this business is in sight. Data from specific plants were given, with over-all energy consumptions per unit of output.

E. L. Crosby, Detroit, presented operating results with furnaces in various places, including a Connecticut rolling mill handling sixty-forty brass on 210 kw.-hr. per ton. About seventy-five electric brass furnaces are now in operation in the country, the speaker said. He also outlined the advantages of electric smelting. E. F. Collins, Schenectady, N. Y., emphasized the value of the electric furnace in securing improved quality of products, notably in producing non-porous castings. He maintained, with examples from practice, that the energy rate is of less importance than the quality of yield.

STEEL-MAKING ELECTRIC FURNACES

C. B. Gibson, Pittsburgh, referred to the stimulation of the market for electric steel by the war. Steady growth in demand is anticipated, especially from the automobile and airplane industries. Another promising field is the foundry. On Jan. 1, 1919, there were installed in this country about 330 furnaces with a yearly producing capacity in ingots and castings of about 1,400,000 tons and requiring 750,000,000 kw.-hr. An Electric Furnace Association has recently been organized to popularize electric furnace products, etc. Ferro-alloys afford a remarkable example of the value of electric smelting. A. C. Smith, Buffalo, instanced the purchase of electric steel in the United States Shipping Board's work after open-hearth steel had failed to meet requirements.

R. H. Tillman, Baltimore, looked for a more stable demand for electric alloy steel in future. Crucible steel for tools is gradually being supplanted by electric steel on account of the superior uniformity of the latter. It is not practicable to manufacture ahead on alloy steels because the average customer specifies the desired analysis.

W. E. Moore, Pittsburgh, thought that large open-hearth furnaces for general service would not as yet be displaced on a large scale by electric furnaces, but that the demand for the high-grade product of the latter will increase. The yield is greater with the electric furnace, and there is a gain of about 15 per cent in tensile strength and ductility. In one plant 80 per cent of the castings from a converter failed on a bending test, the first of a set of tests required, while 95 per cent of the electric steel castings passed all five tests. Electric steel is being preferred in many specifications to-day.

POWER-FACTOR CORRECTION

R. H. Tillman, Baltimore, outlined the need of making the meaning of power-factor clear to customers. He favored a power-factor clause in all rate schedules for large power installations and urged doing everything feasible to improve conditions.

Robert Treat, Schenectady, N. Y., presented a written discussion with cost curves showing the economic aspects of various methods of power-factor correction and outlining the spheres of synchronous condensers and other equipment for this service. Automatic control of static condensers by time clock is a recent subject under engineering consideration.

B. H. Gardner, New Britain, Conn., cited a case where the power factor in an industrial plant was so low that it was impossible to operate all the motors and where day and night shifts had to be run to meet the situation. The installation of a synchronous motor raised the power factor to about 90 per cent and eliminated all the trouble. Wiring losses increase with low power factors and often justify a substantial investment to keep the motors well loaded and the power factor high. On a load of 100 kw. it is estimated that in one case a difference of 5 per cent in line losses would occur between 85 and 60 per cent power factor, amounting, at 2 cents per kilowatt-hour, to $200 per year. The writer described the evil effects of low power-factor upon lines and generating plants.

Will Brown, Minneapolis, advocated a bonus to customers maintaining good power factors. Joseph McKinley, Pittsburgh, and W. R. McLeod, Jersey City, also contributed to the discussion.

STANDARDIZATION OF WIRING ACCESSORIES

Increased Use of Appliances Should Follow the Interchangeability of Plugs—Salesman Should Be Instructed and Equipped with Data

Several independent subjects were discussed in the report of the wiring committee (R. S. Hale chairman), chief among them being standardization of plugs, safety devices on flatirons, shortcomings of safety codes and the deterioration of rubber insulation.

The chief progress that has been made in standardi-

zation of appliance plugs and housings is due to the consolidation of three of the large manufacturers who have adopted standard prongs and standard housings on their appliances, these being arranged to take interchangeable plugs or even plugs which have been designed for flat or round prongs which may differ slightly in dimensions and in the distance separating them.

However, the standardization of appliance plugs and of the prongs and housings should not be pushed too fast, the committee believes, because it may work out that different distances and dimensions should be used for articles that have heavy duty. All plugs and receptacles hereafter made should be designed for polarity use in the committee's opinion.

Since about 75 per cent of the flatirons, etc., are used from sockets, any rule that would require any special safety device on the wiring would not be apt to increase safety, but to decrease it, because people would connect their devices to lamp sockets to save the expense of safety devices. The most ecective way to reduce the losses by fire is to educate the public against carelessness.

In the opinion of the committee there are many safe forms and methods of wiring which are in effect not permitted by the codes. This is commercially a very unfortunate situation and is something which is seriously hindering the growth of the central-station industry as compared with what the growth would be if the use of electricity were allowed to develop freely by means of all safe methods. The condition particularly hinders the wiring of old houses.

Discussion

In the discussion of Chairman Hale's report, F. D. Pembleton, Newark, N. J., emphasized the importance of educating the public in the proper and safe use of electrical appliances, and called attention to the booklet "The Safe Use of Appliances" just issued by the publications committee.

A. G. De Clercq, Chicago, declared that it would be a mistake to have conductors smaller than No. 14 go into a modern job, and Mr. Platt, Middletown, Conn., also advised against the use of too small wire.

W. H. Blood, Boston, Mass., complimented the work of the wiring committee, but declared that at several points in its report he detected evidences of "intellectual Bolshevism, all the more insidious because intellectual." The wiring code, said Mr. Blood, is primarily the property of the Underwriters, who enforce it to reduce insurance risk. Concerning concentric wiring, Mr. Blood said he was formerly an advocate of this form of construction, but he found he was misled and now wanted to apologize publicly to the association for his former stand. The practice across the water with concentric wiring was, he said he had since found, not applicable to conditions here.

Louis Kalischer, of Brooklyn, N. Y., pointed out that one owner's failure to observe the code affects not only his own insurance rates but those of his neighbor next door. The difference between poor and good wiring, he said, is barely one per cent of the cost of any building.

HANDBOOK

The committee of which R. H. Tilman is chairman has recommended that the "Electrical Salesman's Handbook" be divided into three sections only, one of which would be given to each member of the Commercial Section. Additional subjects have been suggested for inclusion, chief among them being ice and refrigeration, isolated plants, electric welding, electric furnaces, electric heating and drying, cement manufacture and the manufacture of cotton goods.

ELECTRIC RANGES AND WATER HEATING

The Future of Electric Cooking, and How Companies Are Charging for This Service and for Water Heating Only

The sale of ranges in 1918 about equaled that of 1917 according to the electric range committee, of which C. E. Michel was chairman. During the war increase was hindered because manufacturers could not get needed materials, while central stations did not have access to the capital required to make extensions and systems had all they could do to carry war loads alone. Future development of the range business will be seriously hindered in the localities where restrictions are placed on extensions and where the rates for electricity do not permit it to compete with fuel energy. Furthermore, the public must be convinced through united effort that first cost and cost per kilowatt-hour are but a part of the story. The fact should be recognized that gas rates have in many cases advanced faster than those for electricity, and indications are that the ratio will be greater in the future.

WATER HEATING

Heating water by electricity is receiving more consideration than usual at the present time, according to the sub-committee on water heating, especially in conjunction with electric cooking. There have been a few developments in apparatus, such as the plastic-type heater for clamping around the base of the boiler, the rugged bayonet-type heater which can be used as an external circulation, immersion or interior circulation heater, and the carbon-electrode heater.

One company, reporting 724 water heaters in use Jan. 1, 1919, has established a combination rate for energy supplied through one meter for lighting and cooking or heating that makes the rate for cooking about 3.5 cents per kilowatt-hour and for water heating about 2 cents. Another company has a sliding scale of 4, 2 and 1½ cents per kilowatt-hour for the first 30 kw.-hr. per month of active load, the next 90 kw.-hr. and the remainder respectively.

The discussion on the electric range and subcommittee reports was led by J. F. Killeen, Chicago. J. E. Davidson, Omaha, Neb., expressed the belief that education of the public by the central station and manufacturer is the most important thing to be done at this time; one method is to instruct housekeepers how to use electric ranges economically. He also predicted that the electric range would eventually be the primary load of the central station. C. E. Greenwood, Boston, said that in the small communities of New England there are 1500 ranges on the lines and in Boston alone there are over 2000. R. E. Sard, Albany, N. Y., said that the electric range has been proved to be entirely practicable and it is now merely a commercial proposition to develop a load of this nature.

The most optimistic talker of the meeting was D. A. Hegarty of Colorado, who said that the volume of the electric range business does not depend in the least upon the rate of energy supplied. On the other hand

M. S. Seelman, Brooklyn, N. Y., said that the average householder in Brooklyn cannot afford to use an electric range at the prevailing rate. Paul Clayton Mattoon, Ill., said that his company was able to show the utility commission that rates of cooking should be comparable to rates for power. He also warned against providing too large transformers and meters for electric ranges. Among others who discussed this question were Messrs. Kilt, Clark and Anderson. M. C. Osborn, New Britain, Conn., gave a comprehensive survey on the development of electric water heaters in the Northwest. In this section 75 per cent of the homes equipped with electric ranges also have electric water heaters.

COMMERCIAL SERVICE AND SALES METHODS

Co-ordination of Advertising Considered Excellent Means to Obtain Better Results—Merchandising and Electrical Advertising

The creation by the N. E. L. A. of a bureau of commercial relations is recommended by the committee on commercial devices and relations with customers (R. F. Bonsall chairman) so that men specializing in this class of work may have an opportunity for exchange of views and an intimate discussion of papers on these subjects. The committee also suggests that member companies either organize a department to formulate and apply efficient methods of conducting relations with customers or form a committee of members of departments engaged in this work.

Since customers gage a company more by the treatment received at each point of contact than by the actual supply of energy to their equipment, it is important to train employees dealing with customers in the art of securing and maintaining good will. Furthermore, more attention should be given to the method of securing credit information. To facilitate this a standard form should be adopted for exchange between companies of credit information concerning customers who move from one city to another.

In opening the discussion of Mr. Bonsall's report, H. W. Peck, Schenectady, N. Y., explained the plan for the exchange of credit information employed by the Empire State association, which has been found very useful. Mr. Peck advised against returning customers' meter deposits at the end of twelve months, since some customers leave town without ceremony after several years' patronage of the electric company's service.

Henry Harris, Pittsburgh, Pa., advised paying the customer interest on his meter deposit each year, instead of waiting until it is asked for. Since losses through bad collections total only one-fifth of 1 per cent, said Mr. Harris, it might be advisable to accept this as an operating charge and eliminate the trouble and expense of collecting customers' deposits or securing credit information.

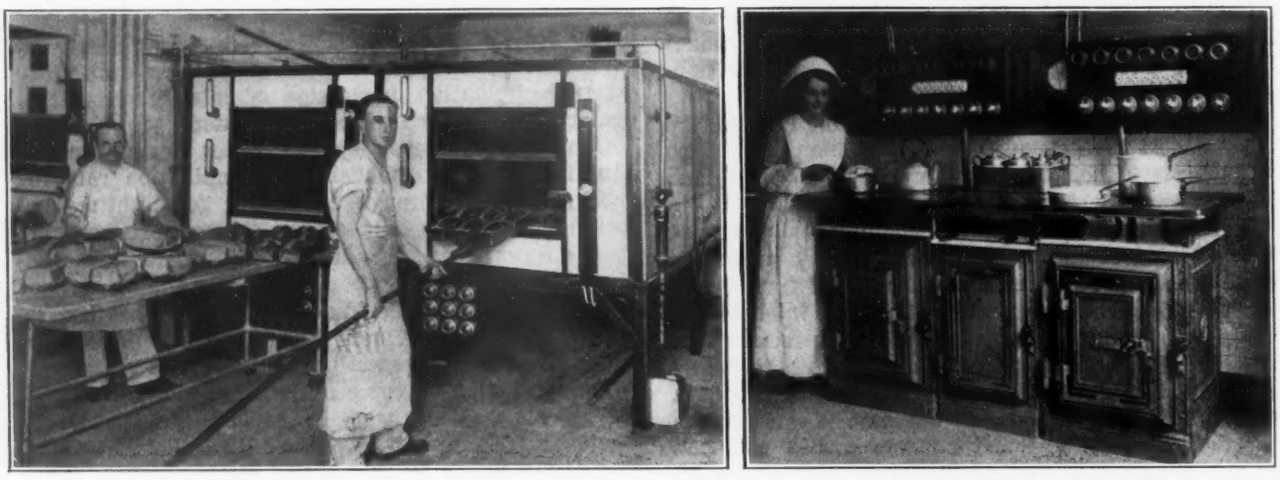
J. B. Seaman of Philadelphia urged the use of cyclometer or figure-reading dials on customers' meters.

In an effort to eliminate the present duplication of effort and expense by manufacturers and central stations in producing literature on show-window, store and sign lighting, the publications committee (F. D. Pembleton chairman) has asked various manufacturers to coöperate with the committee in the production of literature of this nature. Only one manufacturer considered the matter and he declined to join in such an effort.

Cost accounting, coöperation according to the Goodwin plan, standardization of plugs, margins of profit and merchandising of lamps are the principal subjects discussed in the report of the merchandising committee (E. R. Davenport chairman). No two central stations that are supposed to know the cost of operating their appliance departments were found to agree as to the details. The committee recommends that central stations develop branches of the electrical industry where team-work and coöperation do not exist at present.

Central stations are urged to give special attention to pushing the sale of table and floor lamps, which constitute a very profitable phase of the appliance business.

The coördinating of advertising and sales effort, instead of the haphazard display of a full line of products with little information that will appeal to the general public, is bound to bring benefits, the committee on coördinate advertising and sales campaigns (Henry Harris chairman) reported, because of the intensity of such a campaign and the fact that the public's attention can be focused on specific articles by definite appeals in terms of human interest. Therefore the committee recommends the simultaneous advertising of an electrical leader nationally by all manufacturers, accompanied by campaigns that will bring customers.



HOMES, RESTAURANTS AND COMMERCIAL ESTABLISHMENTS ARE ALL USING ELECTRIC RANGES

VEHICLE SECTION

Unusual interest shown in all of the vehicle subjects, particularly in the growing field for trucks and tractors—Factors that will develop this business.

THE Electric Vehicle Section of the N. E. L. A. laid plans at Atlantic City to increase the use of electric vehicles by the aid of educational propaganda. Engineers, preferably independent of the association, will study the transportation problems of prospective truck buyers and attempt to show the public that in its field the electric vehicle is more satisfactory and economical than either gas cars or animals.

Both sessions were devoted to the study of commercial vehicle problems as far as they could be separated from those of the pleasure cars. Comparative operating figures compiled from the records of 5-ton electric and 5-ton gas trucks showed that whereas twenty-five electric trucks cost on an average $13.28 per day over a period of one year, an average of eight users of gas trucks paid out $29.20 per day per truck. Some even more remarkable savings were shown for industrial tractors. In one case the installation of this method of handling freight enabled the Emergency Fleet Corporation to save 450 men who were previously required for loading ships. At another point the government saved $40 per day on each of forty-three industrial tractors, and what was more important at the time released ten men per tractor for other duty.

FEDERAL AND MUNICIPAL TRANSPORTATION

Electric Vehicles Adopted Extensively for Use on Piers, and in Warehouses, Munition Plants, Etc., During War

During the war the government purchased many hundred industrial trucks directly, and many manufacturers of war materials bought and applied industrial trucks. The committee on federal and municipal transportation, of which James H. McGraw was chairman, asserted that, while it may not be generally known, it is fair to say that the industrial electric truck played a most important part in getting our Expeditionary Forces overseas and aded in no small way to the increased production in war munitions plants by speeding up the handling of materials in process of construction.

The introduction of the industrial electric truck into the transportation system in both war and peace times often brings about an overhauling of the transportation methods employed before. The truck itself is capable of handling much larger loads, and as a consequence production will often be automatically speeded up to meet the facilities offered by the introduction of the truck.

In the municipal applications of trucks no particularly new departures have been made during the year, but the electric vehicle continues to be used for street-cleaning work, and both New York and Columbus have added more trucks for street-cleaning purposes. In Columbus a tractor is employed with a trailer and a two-section side-dumping body capable of handling 10 tons gross. The Post Office is using up second-hand army gas trucks. Electrics may be bought later by the government.

Discussion

Van C. Brandt, Philadelphia, said in discussing this report that at one place in New Jersey the government saved $40 per day on each of 43 industrial tractors and, what was even more important at the time, released ten men per tractor for other work.

George B. Foster, Chicago, said he thought that industrial tractors would be the means of putting storage batteries into industry. The number of employees trained in the care of batteries would tend to increase the general use of electric vehicles. One concern with an inside loading platform changed from gas to electric trucks, left the cars at the loading platform at night and saved the garage expense.

TRANSPORTATION ENGINEERING

The two main points that the transportation engineering committee desires to get before the industry, according to its chairman, F. M. Feiker, are, first, that the electric truck as a method of transportation was never more in favor by the truck users of the country; second, that the use of electricity in transportation is a development commensurate only with the size of the problem and the ability of the men in the transportation branches of the industry to see that electricity is applied in every way possible to solve this problem economically.

Through a sub-committee under the chairmanship of A. A. Norris, correspondence is being carried on with educational institutions, with the idea of coöperating in the establishment of transportation engineering courses and the furnishing of data on the place of the electric trucks in commercial and industrial fields.

Discussion

Chairman E. S. Mansfield referred to this report as a progress record, the importance of which had not been emphasized by the chairman.

F. W. Smith of New York said that his company placed its vehicle records at the disposal of all member companies, although some other companies were not equally liberal.

George B. Foster of Chicago believed that all the records should be made available to the industry, but asked that the figures be carefully checked and apparent inconsistencies explained before records were allowed to go out.

R. B. Grove of New York City and D. H. McDougal of Toronto also contributed to the discussion.

STATUS OF THE ELECTRIC VEHICLE

"The outlook of electric truck manufacturers has never been brighter than it is at present," said Rodney K. Merrick, in a paper entitled "The Present and Future Status of the Electric Vehicle," "and the next five years should be banner ones in the history of the industry." There are several reasons for the increased

popularity of the electric truck. First, and perhaps most important, the modern electric truck is a vast improvement over its predecessor of eight or ten years ago. Besides, the modern battery lasts longer, is cheaper to buy, cheaper to maintain and has a higher capacity for a given weight. Motors, controllers, axles, frames and steering gears have all been improved, and a rugged, sturdy but lighter truck has been the result. Hence greater mileage range, fewer troubles and lower operating costs.

Electric truck manufacturers, where they are on the job, will get business, and with intelligent coöperation between the manufacturer and the central station, both doing their part in giving service, the electric truck industry will develop tremendously in the next few years.

Discussion

Frank C. Reilly, New York, said that the high speed of the gas trucks is a liability rather than an asset as it causes high maintenance costs. Two smaller electric trucks will give better service than one 22-mile to 25-mile per hour gas truck. The operators of electric cars can be obtained for $5 or $6 per week less than the wages paid to gas-car drivers. Several speakers mentioned the need for a larger number of electric garages and service stations.

NEEDED LEGISLATION AND STANDARDIZATION

More Favorable Tax Being Sought for Electric Vehicles —Garage Rates and Battery Charging Becoming More Uniform

No state laws, so far as they have come to the notice of the committee on legislation (G. A. Freeman chairman), have been passed which are dangerously discriminatory against the electric vehicle, although several states have very high-license fees in comparison with other states. Therefore it is rapidly becoming desirable to have a uniform vehicle tax law. The National Automobile Chamber of Commerce is working toward this end, and the committee suggests coöperating with this association, taking care to obtain, if possible, a differential in favor of electric vehicles because of the smaller amount of road wear caused by them compared with other power-driven vehicles.

STANDARDIZATION

Very little standardization of vehicles occurred during the war, according to the standardization committee (E. R. Whitney chairman), although a number of other features closely related thereto were under consideration. For instance, it was decided that in order to sell the maximum number of vehicles it is desirable to make the batteries in various makes of trucks interchangeable. This plan would require standard dimensions, arrangement of cells in trays, arrangement of trays, location of polarity of terminals and method of changing batteries. In turn the last feature would require consideration of side loading, permanent frame truss rods, possibility of removing a single individual tray, and ability to put battery directly into the truck or remove it from the truck with one handling. In addition, lightness, over-all dimensions, compactness, cheapness, simplicity, ability to keep out dirt and hold heat in cold weather, ventilating in hot weather and ability to change quickly have to be considered.

GARAGE AND RATES

Electric garage rates are reported by the committee on garage and rates (C. H. Miles chairman) to be largely standardized at the present time. Most member companies are providing a rate that is favorable to the electric vehicle, and garages are being established wherever the demand seems to be sufficient to warrant them.

The need of garage facilities, especially for commercial vehicles, has been felt particularly during the war period, and two more large electric garages have been provided in New York and another in Chicago. A large one is now in the process of building in Boston, and still another is being considered.

POSSIBILITIES OF ELECTRIC VEHICLES

Ten or twelve manufacturers are now making industrial vehicles, E. J. Bartlett reported, about one-half of them producing the majority of the machines sold. The others are building in a smaller way and are developing to a point where they can enter the field more aggressively. The total of the manufacturing capacity at the present time is about 5000 machines per year. The battery manufacturers are wide awake to the opportunities in the industrial-vehicle line and deserve much of the credit for the aggressive work done. Manufacturers of charging equipment are also specializing on apparatus suitable for industrial vehicles. It is interesting to note that new factory buildings, terminals, warehouses and similar buildings are being constructed with a view to utilizing electrically propelled vehicles for handling materials.

Different authorities have placed the quantity of electric industrial vehicles in use at the present time all the way from 6000 to 15,000. Allowing for the older machines discarded and the considerable number exported, Mr. Bartlett believes the number in use in this country to be approximately 8000 machines of all types, a large percentage of these having been built during the past two years.

Some of the common types of vehicles, such as the industrial tractor, three-wheel and four-wheel tractor, industrial truck, utility truck, baggage truck, low-platform truck, lift truck and special industrial truck, are described in the paper by Mr. Bartlett.

Discussion

George Drake Smith, Orange, N. J., referred to the success of the industrial tractors and said that out of nine inquiries recently received for electric trucks seven were from users of industrial tractors.

In reply to a question by W. P. Kennedy, New York, Chairman Mansfield said that in his opinion central stations are interested in the sale of electric trucks even though used by isolated plant operators. Service necessary for charging electric trucks at night often leads to the shut down of the isolated plant.

COÖPERATION

In its report on coöperation by manufacturers and central stations, the committee, of which George B. Foster is chairman, pointed out that, owing to radical changes in the cost of manufacture and operation, it is imperative to accumulate data which are suitable for application to to-day's conditions and to place this information in the hands of engineers, both operating and consulting, and in all institutions where engineers are trained.

All of the vehicle manufacturers are enjoying an abundance of business, notwithstanding the sudden curtailment of the so-called war industries by the signing of the armistice. Most of this business is confined to a comparatively few leading lines of industry, as, for instance, express companies and foodstuffs.

Discussion

In opening the discussion George Drake Smith said it was significant that gas-truck manufacturers are now featuring transportation and service rather than details of construction. In the opinion of the speaker there should be more electric vehicle manufacturers, and they should all push the transportation idea.

F. M. Feiker, New York, said that a good appearance, which so often sells pleasure cars, carries little weight with the buyer of trucks. Business men buy trucks and tractors on an efficiency basis, and if the electric vehicle man only gets a hearing the economy of his machine should do the rest. The public at large is apt to discount the work done by "electrics" because

TRUCKS AND TRACTORS AND PROPER APPLICATION

Relation to Central-Station Load—Some Views Taken by Users and Salesmen Regarding Electric Vehicles

The most important of all motor-trucking questions, said E. E. La Shum in his paper entitled "The Electric Truck in Modern Transportation," is the proper selection of equipment; after this is done careful attention must be paid to its proper operation, especially regarding routes, drivers, helpers, loading and unloading facilities, maintenance and battery charging.

Electric vehicles are not affected by extreme weather conditions, and the American Railway Express Company has found them entirely capable of operating on heavy grades as are to be found in Kansas City, St. Louis, Minneapolis and other equally hilly places.

The fact that the electric vehicle is inherently free from excessive speeding diminishes the number of probable accidents. Small possibility of fire hazard is also

ELECTRIC VEHICLES AND TRACTORS ARE COMING TO BE USED EXTENSIVELY AT TERMINALS, IN INDUSTRIAL PLANTS AND FOR GOVERNMENT AND MUNICIPAL SERVICE

there is no puff and blow to indicate when they are pulling a heavy load.

D. H. McDougal of Toronto, Canada, said that the opinion is often expressed that the weather in Canada is too severe for electrics, but that his own experience in the use of electric trucks in Toronto has shown them to be eminently satisfactory.

Chairman Mansfield said that during the severe winter of 1917-18 one concern in Chicago had to tow into the garage twenty-seven gas trucks and twenty-five electrics. All the gas cars had to be sent to the shops for repairs, but the electric trucks only needed recharging. Some spectacular performance was thought to be necessary to overcome the apathy of the public towards electric vehicles, and this may be forthcoming shortly.

one of the advantages of the electric truck. Its life is very long, some having been in operation for eleven years.

The average of a compilation of costs received from several cities in the Eastern, Central and Southern States are given in the table:

AVERAGE EXPENSES PER VEHICLE FOR ONE MONTH

	Days in Service	Total Mileage	Electricity	Battery Repairs	Tires, Repairs and Renewals	Painting	Body Repairs	Chassis Repairs	Garage Expense	Total Expense
Boston....	23	490	$9.50	.....	$7.34	$0.65	$5.15	$33.07	$36.95	$92.64
Cleveland..	23	495	10.09	$12.39	4.33	1.38	4.75	25.39	14.28	72.61
Memphis..	26	607	23.87	7.85	5.84	1.31	6.67	3.88	18.22	67.64

Discussion followed in which W. H. Blood, Jr., Frank W. Smith, George Drake Smith, A. B. Cole, John F. Gilchrist and Frank C. Reilly took part.

THE USER'S VIEWPOINT

Letters giving the experience of users of electric vehicles were the basis of a paper presented by George B. Foster. In this paper it was pointed out that many of the less up-to-date laundries are still using horses and are therefore good "prospects" for electric vehicles. One creamery using electric trucks said that its deliveries could not be made by gas trucks so quickly nor with such satisfactory results as with electric trucks.

PROPER APPLICATION

Considering the proper application of the commercial electric vehicle, F. F. Sampson said that, unfortunately for the electric vehicle and for persons who are striving to reduce the cost of transportation, a number of misapplied installations have retarded its general adoption. The misapplications may be generally divided into five classes:

First—When the mileage required is too great to be covered by the capacity of the battery and there is no opportunity or time for a boosting charge.

Second—When, for a variety of reasons, it is impossible to justify the cost on account of local conditions. This is usually in extremely congested districts, as around docks and piers, where the vehicle may be kept waiting in line for hours.

Third—When the vehicle used is not of the proper carrying capacity.

Fourth—When it is found impossible to garage the vehicle satisfactorily.

Fifth—Where the purchaser cannot be persuaded to invest in dependable motor transportation equipment and buys solely on the basis of the purchase price.

The solution of the first three troubles is intelligent selling; that of the last two, a wider distribution of facts and data on the electric vehicle.

Assuming fairly good road conditions, the electric vehicle may be used economically wherever any vehicle may be used—provided that energy for charging is available at reasonable rates—on any work within a radius of operation of 45 miles (72 km.) in the case of the ½-ton and 1-ton vehicle; 40 miles (64 km.) in the case of the 2-ton; 35 miles (56 km.) in that of the 3½-ton and 5-ton, and where the running time is not less than two hours per day. These mileage limitations may be increased provided that there is an opportunity for a boosting charge, or, in some cases, where road conditions are exceptionally favorable, as in many of the large cities.

According to W. M. Halsey, Newark, N. J., maintenance contracts for electric trucks should not be necessary. In his opinion, the electric vehicle has passed the stage where such guarantees are necessary, and it may appear to competitors that there is a lack of faith in the electric vehicle.

F. C. Taylor, Rochester, N. Y., called attention to cleanliness of the electric truck in dealing with bakeries, dairies and other dealers in foodstuffs. He also pointed out that the electric can be taken into a building and loaded for the night, ready for the driver in the morning. This cannot be done with gas cars on account of insurance restrictions.

Considering the electric vehicle from the salesman's viewpoint, J. B. N. Cordoza outlined obstacles salesmen will encounter. Reliability is no longer questioned, as the electric truck, when it has proper attention and is used within its scope, is the most reliable transportation device known. The electric truck is beginning to receive deserved recognition in the shape of large sales, but they are far from what they should be, partly because the average buyer does not believe the low cost of operation claimed by the various manufacturers is possible. To correct this impression the speaker suggested the establishment of a fund of about $50,000 to be used in retaining the services of three unbiased, nationally known consulting engineers to make a report on the average cost of operating electric and gasoline trucks under similar conditions.

COST OF OPERATION OF SOME TRUCKS IN NEW JERSEY FROM AUG. 25 TO SEPT. 25, 1916

Truck No.	Capacity of Truck, Tons	Route	Average Daily Mileage	Gals. Ice Cream Delivered in 31 Days	Average Daily Energy Consumption, Kw.-hr.	Average Daily Cost Power at 2.66 Cents, Kw.-hr.	Average Daily Total Cost	Average Cost per Gal. Ice Cream for Delivery
78	5	Elizabeth and Elizabethport	20.8	4031	41.3	$1.09	$8.98	$0.069
79	3½	Irvington, Hilton, Maplewood, Millburn, Summit, Chatham, New Providence and Berkeley Heights	29.7	1456	53.5	1.42	8.60	.183
80	3½	Elizabeth, Cranford, Westfield, etc., to Fanwood	35.0	1800	46.9	1.25	8.43	.145
81	5	Irvington, Newark and the Oranges	20.9	....	30.8	.82	8.71	.082
82	5	Newark (South End)	15.8	3285	19.9	.53	8.42	.082
84	3½	Elizabeth and Elizabethport	22.7	3163 2295	32.4	.86	8.04	.109
86	3½	Newark, East Orange and Bloomfield	23.6	2362	24.9	.67	7.85	.103
88	3½	Newark, Belleville, and Nutley	24.2	1862	26.2	.70	7.88	.131
89	5	Newark (East End)	16.5	2502	29.9	.80	8.69	.108
90	2	Irvington and Hilton (2 trips)	14.8	2538	22.9	.61	6.92	.085
91	2	Newark (West End) (2 trips)	15.1	1756	21.1	.56	6.87	.121
93	3½	Newark (North End)	21.0	2562	19.4	.51	7.68	.093

New users are told to charge the maintenance and renewal of the battery to the daily cost of operation and carry this fund at interest until battery-renewal time arrives. However, many fail to do as directed, and then are faced with a big expenditure which prejudices them against electric vehicles.

Discussion

H. H. Smith of Orange, N. J., pointed out that central stations might profitably assist electric vehicle users in financing needed converting apparatus where only alternating current is available. What now appears to be a low rate for electric service is often made prohibitive by the losses and overhead expense of the transforming apparatus.

A. Jackson Marshall, New York, referred to operating records of eight users of 5-ton gas trucks which showed the average operating cost as $29.20 per day. A year's record on twenty-five electric trucks of the same size which average 25.2 miles per day showed a cost of only $13.28 per diem, which is less than half the cost of the gas truck. These figures cover all costs including delays, overhead, etc.

W. Van C. Brandt said that many people do not know that a 5-ton electric truck cost less than half as much to operate as a gas truck of the same size.

ACCOUNTING SECTION

Education of utility accountants and reducing the burden on the companies involved in preparing commission reports were two of the subjects most discussed.

STIMULATING and enjoyable sessions of the Accounting Section marked the convention program. At the opening session on Tuesday much interest was aroused in the educational program of the section, which has found fruit in the preparation of elementary and advanced courses in electric utility accounting, now available at moderate cost to employees of member companies. The high plane that modern accounting should take in relation to the changing era in which the industry finds itself was also voiced by a number of speakers, and the advent of the accountant as a man of larger affairs in future was predicted.

Considerable attention was given at the opening session to the importance of spreading the gospel of accounting as set forth in the N. E. L. A. classification. This, it was shown, is adaptable to large and small companies, as well as intermediate properties, and it is greatly to be desired that the public utility commissions and the association accountants take common ground in its application. The recently completed arrangement for full discussion of accounting classification between representatives of the N. E. L. A., the American Gas Association and the National Association of Railway and Public Utility Commissioners is encouraging evidence of the prospects of closer coöperation toward the laudable end of standardization. Accounting service to member companies is also growing in value and scope.

War service and efficiency problems were featured at the second session, which closed the program. The accountants' war work lacked spectacular aspects, but not a few N. E. L. A. Accounting Section members performed tasks of very high value and importance in the cause of the Allies.

UNIFORM CLASSIFICATION OF ACCOUNTS

Cost Accounting and Statistics—Commission Accounting Rulings—Accounting Service to Member Companies

Hope of securing a standard classification of accounts acceptable to public utility commissions was expressed in the report of the committee on the uniform classification of accounts, presented by chairman William Schmidt, Jr., Baltimore.

The committee's work was severely handicapped during the past year by war conditions, owing to the reduction of forces. Since hostilities ceased the outlook has been improving, and further efforts are now being made toward the adoption of a national standard of classification. The present standard of the association was adopted in 1914 and has remained unchanged. Some of the state commissions have adopted this, and a committee of the National Association of Railway and Public Utility Commissioners has been appointed to confer with representatives of the N. E. L. A. and of the American Gas Institute. President C. E. Elmquist of the Commissioners' Association, Washington, is greatly interested in this work. Exhaustive comparisons have been made between the N. E. L. A. and various state systems. The principal differences are in the rules prescribed for the retirement of property and the treatment of the depreciation account.

Considerable difficulty has been experienced in carrying out the provision of the commission's classification of fixed capital. The rule as prescribed makes it necessary, when retiring property, to obtain the date on which the property was put in service. If prior to the adoption of the commission's classification, then the original cost of the property retired must be credited to the fixed capital account; if subsequent thereto, it must be credited to one of the sub-accounts of the fixed capital account prescribed by the commission. Piecemeal development renders this most difficult to do.

Discussion

S. B. Cushing, Chicago, said that each public utility expects company managements to use their best judgment in regard to plant cost at the time of installation prior to the adoption of the standard classification. He questioned the practicability of accurate age determinations. E. H. Davis, Williamsport, Pa., questioned how many companies actually determine the age of displaced equipment. H. M. Edwards, New York, said that while accounts should truthfully exhibit events, it is most difficult to determine where property stood as to cost prior to the adoption of the standard classification. Others recognized the necessity for using estimates in such cases. S. J. Palmer, Chicago; E. C. Scobell, Rochester, N. Y., and W. C. Bingham, Buffalo, also discussed the report.

Cost Accounting Statistics

Because of the complex nature of cost accounting, the committee on cost accounting and statistics (A. D. Spencer chairman) suggests that its work be carried over and that the object of the committee be changed to the following: "To study principles of cost accounting for electric light and power companies and to recommend to the association methods and sytems that may be of value to the member companies."

Commission Accounting Rulings

A classified list of all public utility commission accounting rulings issued up to the present time is being compiled by the committee on this subject (H. E. Addenbrooke chairman) in order to permit a comprehensive study of them. The committee believes that the time is at hand when the subject of the cost of issuing bonds, notes and obligations and the discount in connection therewith should be given most careful consideration, since the rulings of the various commissions on this subject appear to be contradictory. Depreciation, too, should have particular study, from an accounting point of view, not only for the reasons which have heretofore existed and which to-day continue with undimin-

ished force, but also for the further reason that the Internal Revenue Department of the United States government recognizes, and perhaps emphasizes, the importance of the subject. Another subject that should be given careful study is that of reserves for replacements, sinking funds, etc.

EDUCATION IN ACCOUNTING

During the past year effort has been made by the committee on accounting education (H. B. Lohmeyer chairman) to bring before the industry the value and importance of the accounting courses and to complete all the lessons of the advanced course. The advanced course, now almost completed, is not the usual accounting course, such as offered by the various schools and universities throughout the country, but applies particularly to the public utility business. Its equal would be hard to find because it has been written by men who are specialists in the various subjects embraced. The scope is such that it will meet the needs of the operating man and the commercial man as well as the accountant.

The preparation of the thirty-six lessons in the advanced course is nearly complete. Sixteen authors and nine editors have been engaged on this work, all being accountants and utility men of wide experience in the industry and in educational work. So far, 700 elementary and seventy-four advanced courses have been sold. Considering the war, good results have been obtained from the three months' campaign of nation-wide scope which was run last year. A joint educational campaign is now under way with the coöperation of the Commercial Section. The advanced course is unequaled in the United States in its usefulness to the electrical industry, and it is designed to appeal to the operating and commercial man as well as to the accountant.

Discussion

Douglass Burnett, Baltimore, expressed his great interest in the educational courses and pointed out how the need of standardizing instruction had led to their preparation. Every author responded to the committee's request for coöperation. These courses bring young men into contact with operating and executive problems and represent a notable forward step in the work of the section. The lessons should now be exploited to the full and executives should see to it that their employees know about them. Pay-roll slips should be utilized to bring the matter to the attention of employees. H. M. Edwards, New York, said that these lessons typify what the association should do for its young men. Any young man who will take these courses and complete them thoroughly will be fitted to run an accounting department, and young women should not be overlooked either. P. R. Jones, New York, paid a tribute to the work of Mr. Burnett on behalf of the educational courses, in the absence of Captain Lohmeyer.

ACCOUNTING SERVICE TO MEMBER COMPANIES

Owing to the unsettled conditions prevailing during the war and the resulting inactivity of most of the committees of the Accounting Section, the committee on accounting service to member companies (Frederick Smith chairman) served as an emergency committee, rendering service to member companies irrespective of their size. Now that conditions are returning to normal, it is the opinion of the committee that it should confine its work to those inquiries dealing with subjects not specifically covered by any of the other committees. The committee repeats the recommendation made in its 1917 report that the association employ a high-grade man well versed in all phases of accounting to visit the small central stations and assist them in initiating a system of accounting suited to their requirements.

Discussion

In the discussion representatives of small companies were particularly urged to criticise the N. E. L. A. standard classification, but few or no adverse points were brought forward. W. A. Jones, Joplin, Mo., said that many small companies have practically no accounting system, or such poor ones that they are unsatisfactory. Lack of familiarity with the N. E. L. A. system has led in some cases to criticisms against its supposed "elaboration," whereas it is flexible enough to fit all sizes of companies and need not be utilized in detail unless desired. Many small companies have been too busy eking out an existence under war conditions to pay attention to proper accounting. Mr. Jones believed that it would be helpful to send an accounting representative to the smaller companies from association headquarters, to facilitate the understanding and use of the association classification. Something also could be done through correspondence. H. Sylvester, Detroit, said that the Michigan Section desires the services of a representative of this kind.

F. E. Webster, Haverhill, Mass., and formerly with the New Hampshire Public Service Commission, praised the association classification, which is the basis of the New Hampshire system. The only troublesome question appears to be that of accounting for additions to and withdrawals from property. H. M. Edwards said that no business lends itself toward standardized accounting so well as the central-station industry. He felt that the differences between the association system and those of many state commissions are complicated, ridiculous and absurd. It is not to the credit of the accountant as a professional man that the statisticians of the commissions marked out so many different systems of accounts. "We must at least agree among ourselves," said the speaker, who pointed out the usefulness of the national classification for both large and small companies.

William Schmidt, Jr., Baltimore, said small companies that subscribe to the educational courses on accounting will have no difficulty in understanding the classification of the association. W. A. Jones, Joplin, Mo., it was announced, volunteered to attend the Iowa Section convention in June on behalf of standardized accounting development.

OPERATING RECORDS

A set of forms which is intended to be universally adaptable to transportation cost accounting has been developed by the committee on operating records, of which C. A. White is chairman. These forms represent composites of forms used by several operating companies and can be printed for member companies at a small price. The size and purpose of each form and the method of filling it out are given in the committee's report.

Discussion

E. J. Fowler pointed out that such forms had been of great value in bringing to light serious overcharging of batteries when it was found that one company was

using twice the kilowatt-hours required by another. He stated also that these forms could be readily abbreviated to suit the needs of smaller companies. William Schmidt, Jr., Baltimore, and H. A. Snow, New York, also took part in the discussion.

MOTOR TRANSPORTATION IN THE ARMY

H. B. Lohmeyer, recently a captain in the ordnance department of the army, read a paper "Motor Transportation in the United States Army." Using many slides to illustrate his points, he showed how army trucks were cared for at the base shops. The system of accounting by which all useful information was obtained regarding the life and cost of maintenance of trucks and their parts was fully explained.

PURCHASING AND STOREROOM ACCOUNTING

The most important work undertaken by the committee on purchasing and storeroom accounting during the last year has been the development of the billing machine for stock-record work, according to its chairman, W. F. Stevens. When the machine is in use the proof-sheets are left in it until full of entries; the various cards are inserted and removed for each entry.

It is yet too early, the committee believes, to determine whether women will ever permanently displace men in any of the strictly warehouse positions, although it is fairly well established that they can be employed more extensively than formerly in the office. The Edison Electric Illuminating Company of Boston, which at one time during the war employed as many as 55 per cent women in the combined warehouse and office of its supply department, found it comparatively difficult to get for stock-room work women who had sufficient physical strength, education and mentality and the desire to learn the work.

CUSTOMERS' AND STORES RECORDS

Development of Billing Machine—Female Labor and Accounting Service to Member Companies Are Discussed

The number of complaints which member companies received last winter was 70 per cent in excess of the previous season's record, according to data compiled by the committee on customers' records and billing methods (H. C. Schlegel chairman). During the same period the number of customers increased only 5 per cent. A large turnover in meter reading, billing and bookkeeping forces was the principal cause of the difficulties and errors which resulted in the increased number of complaints.

It is recommended that ways and means be provided for the betterment and advancement of employees in their own or in other departments of the company. Educational work should be carried on by the companies, preferably during working hours.

Women have been successfully employed and have shown marked ability in several branches of central-station work.

Discussion

That accountants are under great responsibility in the matter of seeing that bills rendered are accurate and that complaints are promptly attended to was pointed out by E. J. Fowler, Chicago. He also said that making out bills by machine was cheaper than hand work.

WORK OF ORDNANCE FINANCE SECTION

In dealing with the "Establishment and Growth of the Ordnance Finance Section," Col. Herbert A. Gidney, Boston, pointed out that prior to the trouble on the Mexican border there was stationed at Washington one officer and six civilians who kept appropriation and allotment records for the Ordnance Department. At this time the total annual appropriation for this department aggregated less than $10,000,000 annually. Since that time appropriations for ordnance have increased to $8,042,041,786. The work of accounting was greatly augmented by the system of separate appropriations in use, although the adoption of a budget system is in sight. The paper contained an interesting account of how these enormous funds were handled.

THE NEED OF BETTER ACCOUNTING

W. B. S. Winans, of Henry L. Doherty & Company, New York, in a paper entitled "The Importance of an Efficient Accounting Department to a Business," pointed out the need of better accounting in eras of expansion and change. Growing exportation problems demand accurate accounting also. An accounting department is as important to a utility as its electric generating equipment, in the writer's opinion. There is a great shortage of accountants at present, due in part to the war, and intensive training is essential. Besides recording operations, the modern accountant should protect a business against unwarranted expense, help make as well as to write history, undertake research work in rate cases and commission hearings along broad lines and exhibit executive ability. The company executive should not assume that because his accountant agrees with everybody and thus gets along without friction he is a top-notch man in his line, or that a desk full of papers signifies progress and achievement. Hard workers laboring long hours at the head of accounting departments are not necessarily giving companies the best possible service. The accountant should not be a mathematical drone, without appreciation of perspective, but a man whom men of affairs and those in the college world will take at his true professional worth.

BONUS SYSTEMS FOR OFFICE EMPLOYEES

An informal discussion of bonus systems for office employees was participated in by E. C. Scobell, Rochester, N. Y.; H. M. Edwards, New York; H. E. Addenbrooke, Chicago, and Capt. H. B. Lohmeyer, Baltimore. Mr. Scobell said that three years ago a bonus system for meter readers, bookkeepers, application counter clerks, etc., was inaugurated at Rochester, and the results have been very satisfactory. The volume of work done has been increased and lower costs per account handled have resulted. The bonuses are applied in group work, and if an employee does not qualify and thus holds back the group effort, he is soon eliminated. Mr. Addenbrooke said that for seven or eight years a bonus system for bill clerks has been used successfully in Chicago. This is available above a stated wage, and it often yields $15 to $20 per month extra to the clerk. More bills are put through and space for clerks and machinery investment and space are saved. The bonus system is now in effect also in the meter and bill delivery departments. In each of these divisions a penalty is enforced in case of error.

Electrical Apparatus Development

The Installation of Fire Extinguishing Equipment and Balanced Relay Protection of Generators Gain Favor—Trend Is Toward Automatic Operation and Standardized Design of Substations—Electric Steel Furnaces Offer Chance for Load Development

A VAST amount of valuable information is given in the report of the committee on electrical apparatus, of which R. F. Schuchardt is chairman. Progress is shown in the protection of generators against fire and in the application of balanced-relay protection. Tendencies in substation practice point toward some standardization in design and increase of automatic operation. The importance of power-factor correction has received serious consideration and static condensers appear to offer advantages for the smaller installations. Industrial loads are growing rapidly, and the supply of electrical steel furnaces, in particular, appears to offer enormous possibilities for central stations. In the year 1918 there was an increase in the number of electric steel furnaces of fifty-four, making the total in this country 287. When it is understood that there were only about twenty such furnaces in the United States on July 1, 1913, the rapid growth of the industry will be appreciated.

EXTINGUISHING GENERATOR FIRES

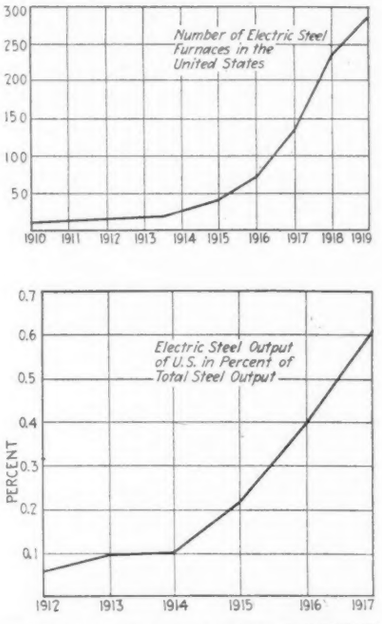
Considerable attention has lately been given and is now being given to the matter of fires originating within the generator shell of turbo-generators of the inclosed type with the object of (a) determining means of minimizing the occurrence of such fires, (b) limiting the extent of the damage to as small a section of the generator as possible, and (c) providing fire-fighting equipment which can be applied quickly where it will be most effective.

The total number of fires referred to by the thirty companies returning the questionnaire was eighty-one, their occurrence being within the past three or four years. Twenty-one fires, about equally divided between 25-cycle and 60-cycle units, were specifically described, occurring in units ranging from 3300 kw. to 35,000 kw. and 2300 volts to 13,200 volts. The various fires have been attributed to many causes. About one-third of the number reported appear to be due to short circuits between conductors and a greater number to grounds, while the remainder are divided among mechanical causes, eddy currents, corona and moisture from faulty operation or from freezing of air-washing apparatus, condensation, etc.

Every precaution should be taken to limit the amount of dirt and oil which may enter the generator, and many companies, particularly on the larger units, have standardized the installation of air washers. Even with the best possible condition of cooling air, however, it is evident that dirt will lodge within the generator, and if a certain amount of oil vapor is also carried into the machine, the coil surfaces and other parts may become coated with grease. Good practice, therefore, would seem to indicate that machines should be opened up periodically for thorough cleaning and possibly for painting. It would pay to give attention to the matter of cleaning at least once a year.

One company feels that additional insulation on the armature coils of generators is as satisfactory a method of reducing the fire hazard as any that has so far been suggested. In some units it can be applied for such a small increase in price that it may be the cheapest of all methods of reducing fire hazard.

In the methods thus far adopted for extinguishing electrical fires, water, steam and carbon-tetrachloride have been used. Water and steam are looked on at present with favor. Large volumes of carbon-tetrachloride would be required for any but very small fires, thus involving great expense, with the added possibility of detrimental effect on the insulating materials and injury to operators from contact with the fumes. Some companies opposed to the use of steam have expressed fear regarding the possibility of detrimental effects of high temperature on the insulation, particularly



GROWTH OF ELECTRIC STEEL INDUSTRY

where steam is applied for a long period of time or where it impinges directly on the windings. The destruction of the japanning on the core laminations by the high temperature is also feared.

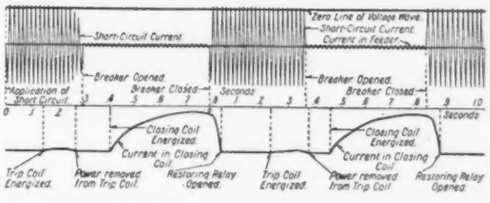
With the advent of permanently installed fire-extinguishing provisions in generators, the use of steam has received very serious consideration, and there is at the present time a wide difference in opinion as to the relative merits of water and steam for this purpose. Of the thirty companies reporting, the use of water is definitely favored by nine and opposed by eight, and the use of steam favored by seven and opposed by twelve. Eighteen generators of four companies are now provided with permanent steam equipment, as against nine units of three companies with water equipment.

With generators discharging air at the top into the turbine room, indication of fires within is promptly given to attendants by sparks, smoke or flame emerging from the unit. The tendency lately, however, in generator design, particularly in the larger units, has been

toward bottom discharge into ducts leading to the boiler room to eliminate noise and to take advantage of the heat in the air. This design brings up a serious problem with regard to visibility of distress. Manufacturers and operators would do well to give serious attention to this matter.

BALANCED-RELAY PROTECTION

It is also rapidly becoming standard practice, particularly on larger units, for the manufacturer to bring out both ends of each phase winding to the generator



OSCILLOGRAPH RECORDS SHOWING OPERATION OF SERVICE-RESTORING RELAY SYSTEM ON A PERMANENT SHORT CIRCUIT
Breaker is shown closed twice—further operation not recorded

terminal boards, so as to permit the installation of current transformers between the terminals of the phase windings and the neutral of the coils. These current transformers can be connected differentially with respect to instrument current transformers in the leads between main oil switch and generator, so that in the event of a fault in the generator or its leads the balanced relay will immediately open the main oil switch, the neutral switch (if closed), and after a slight delay the field switch. Twenty-four of the thirty reporting companies approve the installation of balanced-relay protection and have adopted it as standard practice on all new generator installations and on older generators where the expense involved is not too great.

RATINGS OF OIL CIRCUIT BREAKERS

The A. I. E. E. tentative definition of "Interrupting Capacity" reads as follows (see 1918 Standardization Rules, Article No. 753):

"By interrupting (breaking or rupturing) capacity is meant the highest r.m.s. current at normal voltage which the device can interrupt under prescribed conditions, at stated intervals, a specified number of times."

The manufacturers are basing their ratings at present on no definite prescribed conditions, but on an assumed duty that the circuit breaker will interrupt its rated r.m.s. current twice at a two-minute interval, and then be in condition to be closed and carry its rated current until it is practicable to inspect it and make necessary adjustments.

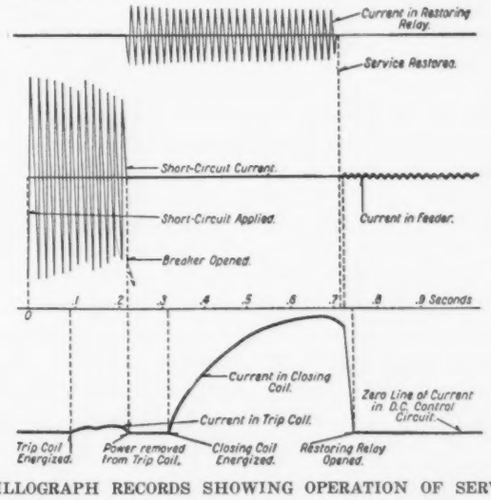
Any such assumed duty should be consistent with usual operating practice, and it is the opinion of the committee that the requirements of operating practice would not permit a time interval as long as two minutes to elapse before a circuit breaker is reclosed. The time interval would probably range from something considerably less than two minutes, under ordinary operating conditions, down to a few seconds, when automatic circuit-breaker reclosing devices are used, toward the adoption of which there is a growing tendency.

The committee suggests that the manufacturers work toward establishing curves for each type and size of circuit breaker, showing the interrupting capacity for various numbers of interruptions and for various time intervals, from that incident to the use of an automatic reclosing device up to a two-minute interval. With such curves there might readily be selected a breaker which would be most suitable for the conditions under consideration.

TENDENCIES IN SUBSTATION DESIGN

While each system seems to follow its own ideas on the details of substation practice in the main, the tendency is toward as simple and inexpensive an arrangement as possible, and invariably toward the use of outdoor-type equipment throughout. Some companies prefer to recommend the outdoor-type substation wherever practicable. These conditions are probably due to the extent of the territory covered by the different companies. In the larger cities it is comparatively easy to give close supervision to each job. In the scattered territories, however, this close supervision is not possible; hence it is more or less necessary that a standard design for a given capacity be followed by the construction force. On outdoor installations some companies use self-contained outdoor metering outfits and report no particular difficulty with them.

Although seven direct-current railway substations of 1000 kw. and above and over thirty of between 300 kw. and 600 kw. capacity have been in automatic operation for some time (not including one 3000-kva. synchronous condenser and one 1500-kw. hydroelectric generating plant which operate entirely automatically), only one lighting company reports substations operating semi-automatically on 115/230-volt direct-current network. This company has had five 500-kw. rotary-converter substations successfully operating semi-automatically for some time. Each substation is located on the fringe of the 115/230-volt direct-current system and is started and stopped by remote control from another substation



OSCILLOGRAPH RECORDS SHOWING OPERATION OF SERVICE-RESTORING RELAY SYSTEM ON A TRANSIENT SHORT CIRCUIT

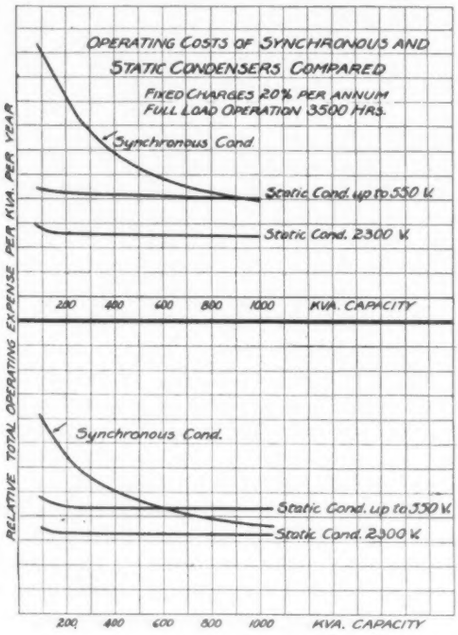
as the load demands, the voltage being controlled by induction regulators installed at the main substation.

From conference with manufacturers, the committee felt justified in venturing the opinion that provided any company desires to operate automatically a substation supplying a 115/230-volt direct-current network, the equipment can be procured.

NEW TYPE OF ROTARY CONVERTER

A new departure in rotary-converter design has been reported which may be of interest. The equipment

consists of a three-unit set of two ordinary 1330-kw. synchronous converters operating at 900 r.p.m., including a revolving-field booster of sufficient capacity for both machines. The three units will be directly connected, comprising a four-bearing set, all mounted on a common base, the booster being located between the two middle bearings. The couplings and booster rotor are of such design as to permit disconnection of one converter armature, leaving the other one free to operate with the booster should accident to first


OPERATING COSTS OF SYNCHRONOUS AND STATIC CONDENSERS COMPARED
FIXED CHARGES 20% PER ANNUM
FULL LOAD OPERATION 3500 HRS.
Synchronous Cond.
Static Cond. up to 550 V.
Static Cond. 2300 V.
200 400 600 800 1000 KVA. CAPACITY
RELATIVE TOTAL OPERATING EXPENSE PER KVA. PER YEAR
Synchronous Cond.
Static Cond. up to 550 V.
Static Cond. 2300 V.
200 400 600 800 1000 KVA. CAPACITY

RELATIVE OPERATING COSTS OF SYNCHRONOUS AND STATIC CONDENSERS

one make this necessary. The booster also may be disconnected, leaving both converters free to operate without means of voltage regulation. The booster is provided with two separate armature windings and the transformer is also arranged with two distinct secondary windings, so that the three-unit equipment may be operated without any electrical connection between the two units on the alternating-current end. This type of unit has the advantage of being much lighter to handle than the ordinary two-unit set, the heaviest part being approximately 40 per cent lighter in weight.

Two companies report that they are experimenting with automatic reclosing oil-circuit-breaker arrangements on feeder circuits. A third company has a small-capacity transformer indoor-type distributing substation with induction feeder regulators and automatic reclosing oil circuit breakers These circuit breakers are provided with special control relay equipments designed to reclose a circuit breaker immediately after it opens on overload. Should the circuit breaker reopen, it will again be reclosed for a total of three operations, all of which take place within a few seconds. After three such operations the main control relay opens the circuit of closing coil of circuit breaker, and thereafter it is necessary to close it by hand. Through the successful operation of this equipment, the length of interruption to consumers is reduced.

More attention than ever is now devoted to means of power-factor correction, according to the committee report. The benefits frequently to be obtained by operating companies from even a slight gain in power factor are very desirable, and it may be advisable for many companies to undertake a power-factor survey of their systems to determine its value at the generating plant, at the various substations, at the more heavily loaded industrial circuits, and finally at the larger consumers' installations, with a view toward ascertaining whether certain remedial steps should not be considered.

Low-speed synchronous motors are suited for direct connection to compressors, refrigerating machines and loads of similar characteristics and have marked advantages in weight and efficiency over corresponding induction motors. High-speed synchronous motors are suited for direct-current generator drive and for general industrial drives where the load is reasonably uniform and the starting and stopping requirements not severe.

STATIC CONDENSERS FOR SMALL INSTALLATIONS

The static condenser has no moving elements and lends itself to smaller installations in which the load and power factor are reasonably constant and at which attendants are not provided. The device is highly efficient, the losses being approximately 1 or 2½ per cent. The manufacturers have recently announced a price revision which will make the first cost of this type less for small capacities at low voltages than the corresponding cost of synchronous condensers, while for the higher voltages the cost will be less than synchronous condensers up to some point beyond 300 kva.

In the past two years there has been in successful operation an automatically controlled 3000-kva., 4000-volt, 720-r.p.m. synchronous condenser connected to the system of the Interstate Light & Power Company at Hazel Green, Wis. The generating station—12,000-kva. connected capacity—is located at Galena, Ill., and the high-voltage lines extend a distance of 70 miles (112 km.) with six substations along the line.

The high-voltage lines traverse a mining district, and the main load is chiefly induction motors. Along the high-voltage lines are many small towns with lighting loads. Induction motors have a definite power factor depending on their loads, and owing to the various applications of this type of motor to mining loads, the system power factor was reduced to an average value of approximately 0.75. The problem of excessive line drop and consequent poor line regulation, also diminishing generating capacity, demanded solution.

The usual method of improving power factor, by means of a synchronous condenser to correct line drop, poor regulation and loss of station capacity, was decided upon, and in order to effect further economy it was decided to make the equipment automatic, using the same simple and rugged type of drum controller as is used in the automatic railway station, to function the equipment in and out of service.

OPERATING DATA FOR HAZEL GREEN PLANT

Kw. Load on Station	P. F. Without Condenser	Kva. Load Without Condenser	Kva. Wattless Without Condenser	Condenser Load, Kva.	Wattless Station Load with Condenser	P. F. of Station with Condenser	Kva. Station Load with Condenser	Increase in Station Capacity
7500	0.825	9100	5150	3000	2150	0.96	7810	1290
7000	.81	8650	5080	3000	2080	.959	7300	1350
6000	.78	7700	4820	3000	1820	.957	6270	1430
5000	.753	6650	4370	3000	1370	.963	5200	1450
4000	.725	5520	3800	3000	800	.98	4080	1440
3000	.695	4320	3100	3000	100	.999	3000	1320
2000	.670	2985	2220	2220	0	1.	2000	985

In observing the results obtained in automatic operation four points stand out prominently:

First—The ease and uniform accuracy with which the equipment is placed on the line

Second—The minimum labor item entering into the cost of operation, this being periodic cleaning and inspection.

Third—The operation of the set in starting only when it is needed, variation of input being dependent upon demand for power-factor improvement.

Fourth—Obtaining uniform smooth voltage charts on numerous small towns tapped from the high-voltage distributing system, by careful adjusting of the voltage regulator correcting power factor at the synchronous condenser substation. It is gratifying to see the splendid voltage charts obtained from these towns contrasted with the charts previous to the installation of the condenser.

The application of automatic condenser stations need not necessarily be confined to long transmission lines. They could be used in many large industrial plants where inexpensive housing may be provided and a careful cycle of operation worked out to insure their use only when desired.

Growing Importance of Electric Furnace

The last few years have shown a great increase in the number of electric furnaces in operation throughout the country, as shown by the committee report. Their superiority over former methods of production may be summed up as follows: (1) Better and cheaper product; (2) adaptability; (3) simplicity; (4) comparatively low installation and maintenance costs; (5) effective and simple control; (6) safety.

A metallurgist and manager of a large reduction company gives the following figures as to power consumed by electric furnaces for several different products:

Products	Kw.-hr. per Ton
Steel	600 to 800
80 per cent ferro-manganese	3,500 to 5,000
Ferro-silicon alloy	7,000 to 9,000
Tungsten or molybdenum	8,000 to 10,000
Metallic chrome (60 to 70 per cent alloy)	10,000 to 14,000

The majority of the steel furnaces installed at the present time range from 1 ton to 6 tons in capacity of metal, the installed transformer capacity for furnaces ranging from 300 kva. to 1500 kva. However, several furnaces of larger size are in operation, the largest being of about 25 tons holding capacity, with transformer equipment of from 3500 kva. to 4000 kva.

Most furnaces are now equipped with regulators which automatically maintain the power input at the desired value, except for the momentary fluctuations which occur when a piece of metal falls against the electrode or something of that sort. These regulators have been developed to a high degree of perfection and give excellent results.

Ferro-alloy and calcium-carbide furnaces are of the arc type, usually three-phase, and vary anywhere from 300 kva. to 20,000 kva. of transformer capacity installed per furnace. Probably the largest single furnace installation which was put into operation in 1918 is the calcium-carbide plant erected by the government at Muscle Shoals, Ala., in connection with the nitrate development. In this plant twelve furnaces are installed, each having about 8000 kva. in transformer capacity.

On account of the serious disturbance to the line voltage of suddenly applied furnace loads this problem is receiving much consideration. One company reports: "We have adopted a rule that in the future all furnace installations must have a reactance such that no more than twice the full normal current will flow even with a short circuit. This has been found necessary, as the substations from which these furnaces are supplied are fed by long transmission lines."

Regarding nitrogen-fixation furnaces, this class of furnace offers good opportunities for the sale of off-peak power, as the furnace may be started and stopped at any time without affecting the character of the product. As the process consists in the formation of nitric oxide from the combination of nitrogen and oxygen at the electric arc, there are no metals to freeze when power is suddenly discontinued. Large amounts of power are usually consumed by an air nitrate factory, the average size requiring approximately 10,000 kw.

Electric Welding Is Developing

It is estimated by the welding committee of the United States Shipping Board, Emergency Fleet Corportaion, that:

1. A saving is effected of (a) 60 per cent in riveting minor parts of a ship; (b) 25 per cent in riveting the hull plates of a ship.
2. Spot welds can be made stronger than the plates joined.
3. Butt-welded joints have 90 per cent of the plate strength and over 100 per cent with butt straps, whereas triple-riveted joints have only 70 per cent or less.
4. As more confidence in the welded joint is demonstrated by actual experience at sea, a 20 per cent saving in steel required may be made in reducing the strength of members of the ship due to the higher efficiency of the welded joints.
5. Greater speed and uniformity on the straightaway parts of ship joints will be secured by the use of automatic welding machines which partially eliminate the human element.

One experimental spot-welding machine built by one of the electric manufacturing companies is supplied from a 2000-kva. transformer, power for which is supplied through a motor-generator set of 6000 kva. capacity. Three 1-in. (2.54-cm.) plates were successfully welded, consuming 72,000 amp. at 20 volts and a pressure of 15 tons.

Electrification of the Oil Fields

As an indication of the increasing favor which electric drive is finding with oil-well operation, one of the largest producers in Oklahoma and Kansas, after an extended survey of operating conditions, placed an order for 700 equipments to be added to thirty former ones.

A few instances are cited to show economies effected in the California field by the installation of electric drive, a large part of the economy being in the decrease effected in the number of interruptions of production. Thus a 22 per cent saving was effected on twelve oil wells, a 36 per cent saving on eight, a 24 per cent saving on twelve, a 40 per cent saving on 107, and a 63 per cent saving on a group of wells (twelve boilers discarded).

During the last year the increased requirements of some of the California deep wells resulted in the development of a heavy-duty oil-well motor. This new motor is of 50/20-hp., three-phase, 440-volt, 900/450 r.p.m. This type of double-rated motor uses the low speed for pumping and the high for pulling.

Tendencies in Prime-Mover Practice

Continuity of Service Must Be Safeguarded as Steam Turbines of Great Size Are Adopted—Boiler and Turbine Room Instruments Show Growing Usefulness—Hydroelectric Developments Should Now Go Forward

ALTHOUGH engineering development of prime movers for power-plant service has been somewhat hampered by the necessity of high speed of production, much valuable experience has been gained. This experience, as pointed out by N. A. Cario, chairman of the committee on prime movers, should have an important bearing on power-plant practice. It was shown that the consideration of service continuity may call for less than the maximum size of steam-turbine unit in many cases. Hydraulic turbines, on the other hand, may well be built in larger sizes than heretofore, especially for such great plants as those now planned at Niagara Falls. The use of boiler and turbine room instruments is rapidly gaining favor among operating engineers, who look forward to the operation of steam and hydraulic equipment from a centralized location similar to the electrical switchboard. Higher steam pressure and other engineering problems are now receiving the combined attention of manufacturing and central-station engineers.

Operating Economy Versus Reliability of Service

During the past two years there has been a marked increase in the number of large units in operation, particularly the horizontal, single-shaft type of approximately 30,000 kw. capacity. It would appear, however, that with the present constructional problems of prevailing frequencies and speeds and the recognized factors of safety, efficiency and cost the size of system to-day will hardly warrant units of more than 30,000 kw. capacity. While every one appreciates the reduction in overhead charges due to the low investment cost per unit installed for these large machines, the low operating cost due to their increased efficiency and the low attendant labor and maintenance costs, yet operating companies must not forget for an instant that continuity of service is the bed rock of any central-station company's reputation and that the truly successful public service company must give the community it serves the best and most reliabie service possible.

Just how far it is safe to go in the installation of large generating units each company must of course decide for itself, but since units of over 20,000-kw. capacity are a rather recent development and since the service factor or ratio of hours available to total hours for some of these units is 90 per cent or less, as compared with 97 to 99 per cent for some of the older units, the importance of giving this matter careful consideration is evident.

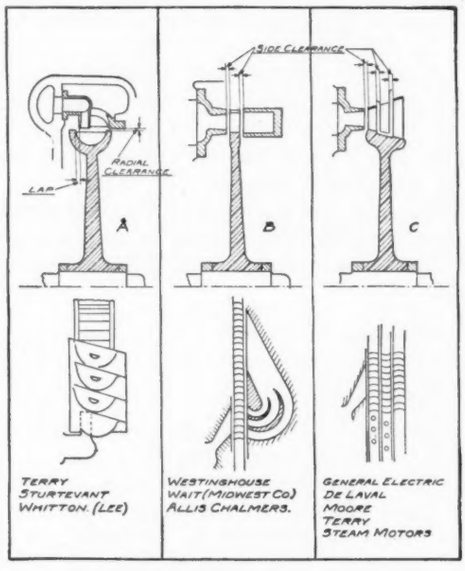
Tandem Versus Cross-Compound Turbines

In dealing with the design of large units a prominent manufacturer states the case as follows:

"The accompanying figures give information regarding our tandem and cross-compound turbines:

Type	Weight	Length	Width	Height	Rating, Kva.
Tandem.....	1,200,000	72 ft. 9 in.	20 ft. 9 in.	20 ft. 9½ in.	35,300
Cross-compound...	1,360,000	47 ft. 8 in.	42 ft. 2 in.	18 ft. 9 in.	47,200

"The cost per kilowatt of the two sizes may be assumed to be practically identical. The steam end of the tandem machine is somewhat more expensive, while the two generators on the cross-compound will exceed the cost of the single generator about enough to equalize. The difference in efficiency between the two types is within 2 per cent. . . . Whatever there is to be said about the two types bears more particularly upon the operation side, and on this question opinions will differ. There are some engineers who seem to prefer the single-shaft unit, as they feel that the single generator best fits the operating conditions. The tandem machine has the merit of dividing the cylinder structure into two parts, which removes the problem of design that comes with an excessively large single-cylinder structure with its possibilities of instability. It also confines the high temperatures to a small steel cylinder, a point of particular importance as we ap proach the question of higher temperatures of steam. It is true that a mishap in either cylinder would be likely to disable the whole machine.



DESIGN FEATURES OF VARIOUS TURBINES

"Our own view has rather favored the use of two separate elements in these larger sizes, and we have gone to three elements in the 60,000-kw. size. We think that the cross-compound offers the maximum assurance of operating reliability. We do not see anything in the operation of a 40,000-kw. cross-compound that presents any new problems over operating two 20,000-kw. single units."

Ejectors for Steam Condensers

The last two years have taxed the condenser builders in the same difficult way as other manufacturing establishments. The necessities of war have restrained development to a certain extent. During this period, however, there has been developed the steam air ejector,

which has come into a very prominent place in marine work and is rapidly coming to the front in its application to power plants. Its unqualified success at sea has shown that it is an apparatus that will soon occupy a very prominent place in future condenser installations.

Recently a number of large condensers installed on General Electric turbines in power stations have been put on spring supports without expansion joints. This method seems to be very satisfactory.

The Westinghouse company recommends hanging the condenser from the turbine foundation, which method is also satisfactory, as it accomplishes practically the same results as the spring. In one case, where the condenser was located 50 ft. (15 m.) below the turbine and there was an unusual amount of expansion in the exhaust piping, the expansion joint was of the mercury type. This expansion joint is nothing more than a mercury seal in the exhaust line, and it allows absolute freedom of expansion. It seals against any vacuum and is even capable of sealing against 5 lb. (0.35 kg.) back pressure.

CENTRAL-STATION SYSTEM CAPACITIES AND LARGE UNIT INSTALLATIONS AS OF MAY 1, 1919

Company and Location	Generating Capacity, Total Kva.	Capacity in 20,000 Kva. and larger Kva.	Per Cent of Total Kva.	Capacity of Largest Unit, Kva.	Per Cent of Total Kva.
Buffalo General Elec. Co. Buffalo, N. Y.	105,555	105,555	100.0	38,889	36.8
Con. Gas, El. Lt. & Pr. Co. Baltimore, Md.	81,500	40,000	49.1	20,000	24.6
Boston Elev. Ry. Co. Boston, Mass.	122,500	35,000	28.5	35,000	28.5
Edison Electric Illg. Co. Boston, Mass.	143,000	30,000	23.8	30,000	23.8
Alabama Power Co. Birmingham, Ala.	140,233	58,333	41.6	33,333	23.8
Edison Electric Illg. Co. Brooklyn, N. Y.	121,500	52,000	42.7	30,000	24.7
Bklyn. Rapid Transit Co. Brooklyn, N. Y.	139,850	51,000	36.6	30,000	21.5
Commonwealth Edison Co. Chicago, Ill.	498,510	227,910	45.7	35,300	7.1
Cleveland Electric Illg. Co. Cleveland, Ohio.	208,000	150,000	72.1	31,250	15.0
Union Gas & Elec. Co. Cincinnati, Ohio.	84,400	50,000	59.3	25,000	29.6
Northern Ohio Traction Co. Cuyahoga Falls, Ohio.	67,000	44,444	66.3	22,222	33.2
Detroit Edison Co. Detroit, Mich.	193,000	105,000	54.4	45,000	23.3
Pennsylvania R.R. Co. Long Island City, N. Y.	78,000	41,100	52.7	21,100	27.1
Twin City Rapid Transit Co. Minneapolis, Minn.	65,000	20,000	30.8	20,000	30.8
Moline & Rock Is. Mfg. Co. Moline, Ill.	50,600	20,000	39.6	20,000	39.6
Interborough Rapid Transit Co. New York City.	389,000	256,000	65.8	70,000	18.0
New York Edison Co. New York City.	286,000	111,000	38.8	30,000	10.5
Public Service Electric Co. Newark, N. J.	265,100	105,000	45.0	35,000	15.0
United El. Lt. & Power Co. New York City.	124,900	65,900	52.8	25,900	20.7
Philadelphia Electric Co. Philadelphia, Pa.	279,700	153,900	55.1	35,000	12.5
Narragansett El. Ltg. Co. Providence, R. I.	85,500	67,500	78.9	47,500	55.5
Duquesne Light Co. Pittsburgh, Pa.	168,000	47,200	28.2	47,200	28.2
N. Y. C. R. R. Co. Port Morris and Yonkers, N.Y.	60,000	20,000	33.3	20,000	33.3
Reading Transit & Light Co. Reading, Pa.	25,000	25,000	100.0	25,000	100.0
Union El. Lt. & Pwr. Co. St. Louis, Mo.	83,000	25,000	30.1	25,000	30.1
United Electric Co. Springfield, Mass.	45,020	20,000	44.4	20,000	44.4
Toledo Ry. & Light Co. Toledo, O.	88,000	45,750	47.0	23,500	26.7
Worcester Electric Light Co. Worcester, Mass.	43,000	20,000	46.5	20,000	46.5
Wheeling Electric Co. Windsor, W. Va.	69,000	60,000	87.0	20,000	43.5

Proper application and limitation regarding the use of insulating brick in boiler settings are becoming better understood, although there is still much widely divergent practice regarding this matter. There is a feeling on the part of operators who have had experience in this matter, particularly in connection with high boiler ratings, that the walls of the furnace should be built of as few different kinds of material as possible and that the walls should be solid, well bonded and homogeneous. The present-day demand is for a furnace lining which will withstand the high furnace temperatures and blow-torch action, the constant heating and cooling effect and the abrasive action of the fuel bed. A furnace lining to which clinker formations would not adhere is very much to be desired, but if this is impossible, it must have the mechanical strength to withstand the necessary barring or breaking off of the clinkers. There are, however, a considerable number of various and diversified means in use for preserving furnace linings.

Boiler-Forcing Rates

In recent large central-station designs maximum boiler ratings of from 250 per cent to 400 per cent have been used in the basic calculations and carried out to a practical conclusion in the plants when put in operation. This tendency toward higher boiler ratings in modern new plants has led many operators to feel that boilers in general should be operated at much higher ratings than in the past, which in a large majority of cases was perhaps a justifiable conclusion if not carried too far. A boiler is often spoken of as being overloaded, when in reality it is the stoker under the boiler which is being forced beyond its proper limit. Generally speaking, the capacity which can be developed by a boiler and stoker unit is limited only by the amount of coal which can be burned by the stoker equipment. Properly speaking, the capacity of the boiler is mainly a question of how high a flue temperature may be tolerated.

The problem of draft loss at high boiler ratings is by no means a small one and is frequently underestimated in connection with increasing the capacity of boiler plants already installed. This may be readily understood when it is considered that the draft loss through a setting increases as the square of the velocity.

The character of the boiler-feed water may readily become a limiting factor in boiler ratings developed, and as a matter of fact this is not infrequently the case. This may occur either through the water containing a troublesome amount of scale-forming ingredients or through the presence of ingredients which cause it to prime or foam.

A concentration test has been developed by the Babcock & Wilcox Company for the detection of priming which is described in detail in the committee report.

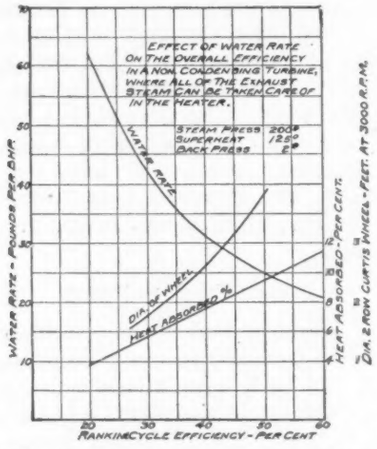
Although there has been little or no improvement during the past year in methods of cleaning external heating surfaces, there has been a very broad movement on the part of operators toward the use of mechanical soot blowers. This movement has doubtless been aided by difficult labor conditions, which have made it almost necessary to resort to mechanical methods of soot removal.

Recent labor conditions have also turned the attention of operators toward the subject of feed-water regulators, with the result that for average boiler-plant conditions and for plants containing more than three

or four boiler units a wise selection of feed-water regulators may now be regarded as standard practice, although there are possible exceptions in which the use of regulators may be inadvisable, such as, for instance, where extremely fluctuating load conditions prevail.

SUPERHEATER REQUIRES DRY STEAM

In connection with a discussion of superheaters it was pointed out that the superheater as such is a very


EFFECT OF WATER RATE ON THE OVERALL EFFICIENCY IN A NON CONDENSING TURBINE, WHERE ALL OF THE EXHAUST STEAM CAN BE TAKEN CARE OF IN THE HEATER.
STEAM PRESS 200#
SUPERHEAT 125°
BACK PRESS 5#
WATER RATE
DIA. OF WHEEL
HEAT ABSORBED %
WATER RATE - POUNDS PER B.H.P.
HEAT ABSORBED - PER CENT.
DIA. 2 ROW CURTIS WHEEL - FEET. AT 3000 R.P.M.
RANKINE CYCLE EFFICIENCY - PER CENT

WATER RATES AND HEAT BALANCE OF A SMALL TURBINE
Shows that a wide range of water rates has a relatively small effect on heat balance of station

efficient piece of apparatus, but as a boiler or evaporator it not only becomes a source of loss through loss of superheat but may be the cause of high maintenance as well. It may be interesting to note that at 200 lb. (17.5 kg.) pressure and 100 deg. Fahr. (56 deg. C.) superheat 1 per cent of moisture in the steam entering the superheat causes a loss of 17 deg. Fahr. (10 deg. C.) of superheat. This discussion brings to light the need for taking every possible precaution to insure steam as nearly dry as possible entering the superheater.

It is thought that the most important developments in the underfeed type of stokers are the power dump grates and the clinker grinders, both of which are coming into more general use. Of these, it is believed that the clinker grinder is the more important, as it eliminates all dumping, with consequent changes in furnace conditions and loss of boiler capacity during the dumping period, and reduces the combustible in the ash to a very low figure.

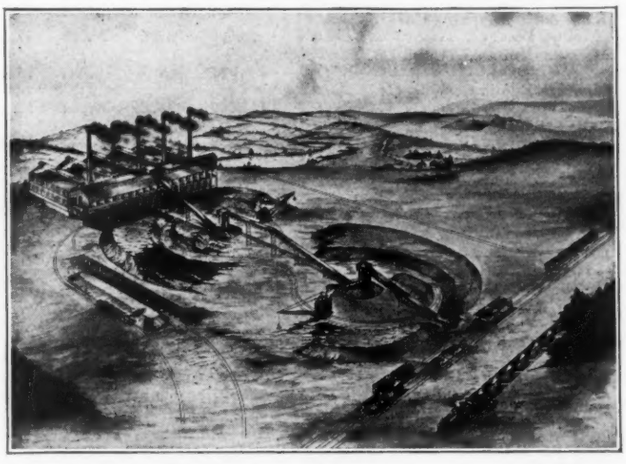
ANALYSIS OF ECONOMIZER PROBLEM

The last extensive discussion of economizers in a prime movers committee report was contained in the 1915 report, in which detailed data were given concerning the practice of the Commonwealth Edison Company of Chicago. In the last three or four years some progress in economizer practice has been made in the United States and abroad; types have been developed for pressures of 300 lb. (21 kg.) or higher, using extra heavy cast-iron or "semi-steel" tubes and improved designs for headers, joints and other details. A few high-pressure steel economizers are in use in this country and a large number abroad. With the higher fuel costs economizers will come into much wider use.

In the operation of economizers it has been accepted almost without argument that to obtain maximum benefit the water should enter the economizer at the lowest possible temperature, the minimum limit being set by external corrosion difficulties. To obtain this low temperature, electric drive is in general adopted for most of the station auxiliaries, and this introduces factors which to some extent offset the advantage gained from feeding the lower temperature water to the economizer. With steam-driven auxiliaries, assuming that the exhaust is all used in the feed-water heater, 1 kw.-hr. of energy supplied to the auxiliaries costs 5000 to 6000 B.t.u., and hence for each kilowatt-hour of auxiliary steam energy displaced by electric drive, in order to keep the feed-water temperature at the entrance to the economizer down to the minimum, about 20,000 B.t.u. are sacrificed. In order, therefore, to realize a net saving on the station operation, the increased efficiency of the boiler economizer plant due to the reduction in feed-water temperature must be more than sufficient to offset this sacrifice.

ECONOMICAL OPERATION OF AUXILIARIES

It has been pointed out that in a modern type of steam auxiliary using 30 lb. (13.6 kg.) of steam per brake-horsepower-hour the cost per brake-horsepower of auxiliary power will be about 4500 B.t.u., provided that all steam is absorbed by heater; also that the excess steam which cannot be absorbed will cost eight to ten times this amount; also that electric auxiliary power from modern prime movers will cost 22,000 to 25,000 B.t.u. per kilowatt-hour. A careful analysis of a given operating condition with these figures in mind will show that the smallest thermal cost for auxiliary power is expended when steam auxiliaries having a minimum consumption per brake-horsepower-hour are used up to the limit of feed-water absorption capacity and the balance of auxiliary power required is taken from the main busbars. The installation of economizers will reduce the desirable limit of absorption by feed water



COAL-HANDLING EQUIPMENT AT UNITED STATES GOVERNMENT EXPLOSIVES PLANT "N" AT OLD HICKORY, TENN.
By a system of belt conveyors and silos the coal is stored or delivered to the bunkers as desired

on account of the greater savings effected by economizers when feed water is supplied to them at lower temperatures than 212 deg. Fahr. (100 deg. C.).

Regarding water rates of auxiliaries the report is quoted:

"It may be well to emphasize again the fallacy of arguments in the past that the water rate of steam-driven auxiliaries is not an item deserving much consideration. The results obtained by some of the more modern plants in the matter of auxiliary power cost

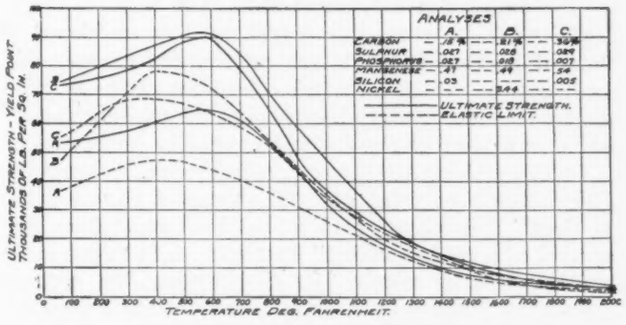
will certainly show the importance of looking into the question of division of auxiliary drive, particularly in the smaller plants."

Writers on the subject of coal storage show very little tendency to agree as to the cause of heating and deterioration of coal in storage. There is considerably more agreement, however, on the results to be expected under certain conditions than there is in the theories offered as to their causes. Among the principles which are backed up by extensive experimental data and widely accepted by the authorities on the subject are:

(1) Coal does not deteriorate seriously unless it heats sufficiently to fire in some part of the pile.

(2) If the pile fires in one or more places, all of the coal in the immediate neighborhood of the fire is absolutely ruined as far as gas and coke making is concerned, though it can still be used as fuel for boilers.

The storage of coal is a local problem. When it is decided that storage is necessary, the best procedure is to determine the quality of protection necessary for the coal one expects to use, if possible, from the experience



EFFECT OF HIGH TEMPERATURES ON STEEL USED FOR BOILERS

Three-cylinder, 1800 and 1200 r.p.m. Comparative performance at 45,000 kw. when supplied with steam having total heat (above 32 deg. Fahr.) of 1280, 1300 and 1320 B.t.u. per pound at pressures from 200 lb. to 600 lb. absolute.

of those who have stored coal from the same district, and then, with the local conditions in view, provide in the cheapest way possible the protection which this experience has shown to be necessary.

Growing Use of Turbine and Boiler Room Instruments

Regarding the use of boiler and turbine room instruments which have been rapidly coming into favor it is said:

"Good over-all efficiency does not necessarily follow from good combustion efficiency, since it is affected by the condition of the surfaces of the boiler, and as an indication of this condition it is necessary to use a flue thermometer in conjunction with the CO_2 recorder. A temperature standard may then be obtained at different ratings by a test upon a clean boiler using proper combustion, and by reference to this in subsequent operation the flue temperature will indicate when the boiler is dirty. A steam-flow meter then also becomes a necessary part of the outfit. . . . Also if the relationship between the amount of air and the boiler output is determined once for all when the boiler is clean and operated at maximum efficiency, this relationship will subsequently serve as a standard by which to operate the boiler."

For the measurement of this flow of air many methods have been devised. In some cases it has been determined by means of Pitot tubes, in some cases by orifices in the pass to the air chamber, and in others by using the boiler setting as an orifice.

Remote control of boilers from a central point does not seem to be out of reach. The method utilizing steam-flow and air-flow meters and flue thermometers offers a most promising solution to the question of boiler operation at the present time. If it is perfected to a greater degree, it will develop the principle of the remote control of boilers.

Choice of Flow Meters

The steam-flow meter has progressed greatly since the last report of this committee, and its accuracy as now designed can easily be maintained within 2 per cent. These meters then may be depended upon for a perfect indication in the boiler room and also may be used in many cases for the sale of steam.

There are two principles used in the measurement of steam by the best-known steam-flow meters. One is based upon the orifice method and the other upon the Pitot tube. Both of these are accurate in results. The Pitot tube has but one disadvantage compared with the orifice. If foreign material is being carried along in the steam, it is apt to clog the openings and cause the meter to read in error. However, where there is no danger from this element, the Pitot tube is just as accurate and reliable as the other.

The orifice type of meter, which includes the Venturi type, is also an accurate means for measuring hot water and is extensively used. The V-notch weir, which has greatly advanced in recent years, is pressing the Venturi meter for a place in this field, and its accuracy and practicability have become unquestioned.

The burning of pulverized fuel for industrial work has developed to a point where the difficulties have been largely overcome, but the committee had very little to report on the successful use of pulverized coal as fuel under steam boilers for central-station work.

While minor troubles have been encountered at all of these installations, such as might be anticipated when the pressure and temperature of the steam system are increased, the committee was advised that in each instance the installation is considered generally satisfactory. While it may be possible to increase the boiler pressure to almost any desired point by changing design, there is to-day a very definite limit to the maximum temperature which it is safe to use. That is fixed by the steels now in commercial use, and appears to be between 600 deg. and 700 deg. Fahr. (315 and 371 deg. C.).

Water Power Should Be Developed

Owing to the fact that steam plants could be built more quickly than hydro plants, construction of the latter has not been pushed during the war. Manufacturers now, however, report very lively interest and inquiries regarding the necessary machinery for large hydroelectric developments.

Some plant designers for large interconnected systems incline toward layouts of few but large units, contending that operating and maintenance costs increase almost proportionately with the number of units and that a few large machines can be brought back into service more quickly after disturbances than a larger number of small machines. The greater the number of plants that are interconnected into one system, the less is the number of units considered necessary to be held as spares.

Melting of Non-ferrous Metals and Alloys*

Complete Domination of Brass-Melting Industry by Electric Furnaces Is Indicated by Data on Saving in Cost of Electric Over Fuel-Fired Furnaces—Many Other Advantages of Electrical Method

EVIDENCE of the great advantages and low cost of melting brass in the electric furnace, compared with fuel-fired furnaces, has been rapidly accumulating. Extensive data are now presented to show that a saving of 100 per cent or more, depending upon the local conditions, may be expected from the electrical method. It is also shown that the danger from gas absorption is greatly reduced since the melt is not exposed to extraneous gases introduced through various kinds of fuel. Thus the product of the electric furnace

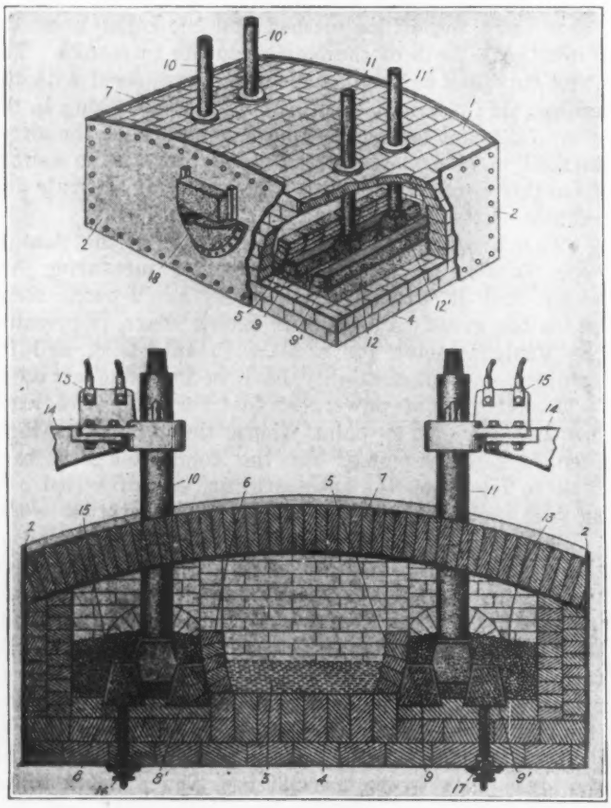


FIG. 1—ELECTRIC FURNACE PARTICULARLY SUITABLE FOR BRASS MELTING

is of a superior quality. The accuracy of electrical control, furthermore, makes possible a minimum loss of metal due to high temperature. For the full realization of advantages inherent in the electrical method a type of furnace with which excellent results have been attained is described in some detail.

CLASSIFICATION OF ELECTRIC FURNACES

It is first desirable to consider the characteristics of electric furnaces and to see how completely they meet the requirements for melting the non-ferrous metals and their alloys.

Class I.—Furnaces in which heat is developed by the passage of current through a solid, laminated or granular conducting medium or resistor.

(A) The conducting medium may consist of material that is to be treated.

(B) The heat developed in the "resistor" is transferred to the charge by conduction or radiation or both; a wall may or may not intervene between "resistor" and charge.

(C) A readily controllable amount of heat is generated between a fixed and movable carbon electrode, their distance apart being maintained such that the granular carbon lying between the faces gives rise to many chains of series and multiple contact or resistance arcs, enveloping adjacent electrode faces.

Class II.—Furnaces in which heat is developed by the flow of current through a liquid or solid conductor: (A) Electrolytic; (B) non-electrolytic.

Class III.—Furnaces in which heat is developed by flow of current through gas or air, for example, arc furnaces in which arcs play between two or more electrodes near material to be heated or between one or more carbon electrodes and charge to be heated.

In the making of brass furnaces each of the three classes has been tried out. Furnaces in classes I and II lend themselves readily to the generation and control of a mild "soaking" heat such as is required for melting volatile alloys. As illustration the common resistance furnace is in class I and the induction furnace in class II. Furnaces in class III generate too intense and burning a heat to be used with even questionable success in melting volatile alloys without the use of much unnecessary manipulation and watchfulness requiring much skill. Control of the electric arcs in atmospheres high or low in volatile gases, freedom from surging, low power factor and high metal loss are some of the serious problems confronting the man who would melt volatile alloys in the class III arc furnaces. Their employment had best be left for steel.

Several years' experience with furnaces falling in class I and type C and results gained from many tests as well as from commercial operation in the foundry constitute the basis of this paper. The design and construction of this type of furnace are therefore given in some detail, and its suitability for melting the non-ferrous metals and their alloys is pointed out.

DESCRIPTION AND DESIGN OF FURNACE

This furnace is shown in section in Fig. 1. It will be noticed that it consists essentially of a refractory lined case, within which are contained in the same chamber the heating units lying on either side of the melting hearth (3). The source of heat is (13) and lies in a duct separated from the bath by carborundum walls (5 and 6). This duct is fitted with cross electrodes 9 and with wearing blocks 12 under each of two vertical electrodes projecting through the arched roof. These cross-electrodes in bottom of duct, as well as the wearing blocks between them and the vertical electrodes, are carbon. The whole duct is filled with granular coke to the height of the bridge wall (5 and 6) on

*Abstract of paper by E. F. Collins, General Electric Company, read before recent meeting of Cleveland Engineering Society.

either side of hearth. Neutral electrodes (16 and 17) make contact with cross-electrodes (8 and 9). This neutral electrode is for the sake of automatic control as will be seen later. The vertical electrode carries a water-cooled ring where it emerges from the top arch; also the cable clamp for electrode (15) is water-cooled. The two vertical electrodes (11) are terminals of one phase, while those marked 10 are terminals of another. In other words, the furnace is inherently

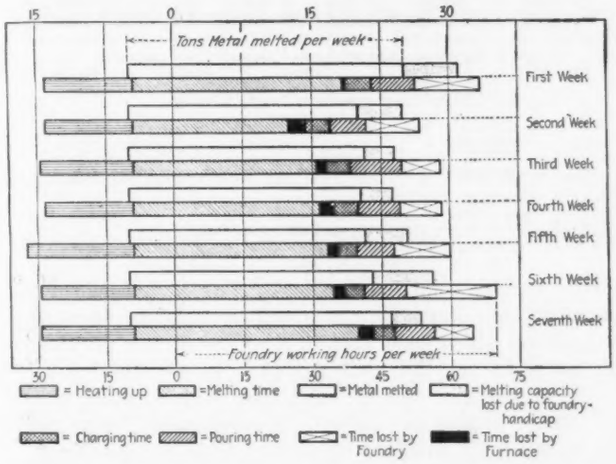


FIG. 2—CHART SHOWING CONTINUITY OF SERVICE OF ELECTRIC FURNACE IN COMMERCIAL BRASS MELTING

two-phase. By multiplying the two phases, however, it may be operated single-phase, or by using Scott transformer connections it may operate from a three-phase source. The phase voltage most satisfactory has been found to be 60 volts to 70 volts.

Referring to Fig. 1, the detail arrangement of the electrodes, etc., in the resistor duct is evident. The operation of the furnace in generating heat is as follows:

When current is supplied to vertical electrodes of phases, it flows through vertical electrodes (10 and 11), through a short space filled with granular carbon, to the wearing block (12), into cross-electrodes (9), into second wearing block (12), and out to line through second granular coke strata and second vertical electrodes. The value of the current is regulated automatically by varying the distance between vertical electrodes and wearing block. In other words, by means of a current-controlled relay the distance between 11 min. and 12 min. is governed; also by means of a voltage-controlled relay connected to neutral bottom electrodes and vertical electrode (11) the distance between electrode (11) and wearing block (12) is held to correspond to one-half the phase voltage; *i.e.*, 30 to 40 volts. A rheostat on the control panel allows of setting control for any current value required, and when one is set for a given value such value is held until the rheostat position is changed by the furnace operator. Hence the power input is automatically held constant and is subdivided equally between the vertical electrodes.

Starting with a cold furnace, heat is generated first in the granular carbon separator lying under the bottom face of vertical electrode. This immediately becomes incandescent by virtue of current carried by carbon granules and also heat generated in a multitude of contact arcs enveloping the lower end of vertical electrode. Heat is at once taken from this source by the granular coke in the trench and its whole surface becomes heated to the desired point.

This heat is radiated principally to the roof, since it is generated largely in the upper surface of the coke body. In addition to serving as the inclosing wall of the furnace the roof is so shaped that it acts as a highly efficient reflector, throwing the heat received from the incandescent coke ducts on either side of the hearth uniformly on the hearth or bath. This heat is very uniform and what is called a mild "soaking heat," and hence it lends itself well to the melting of brass or volatile metals. Especially is this a fact since part of the heat is supplied to the bath from bottom and sides.

To enumerate briefly some characteristics of the above-described furnace which make it essentially suited to melting non-ferrous metals and their alloys, we have the following:

(1) Temperature of heat-generating source controllable at will.

(2) Heat generated is of the mild "soaking" type uniformly distributed, and any workable temperature gradient may be maintained between charge and heat source.

(3) Heat received by charge, from above, on sides and through bottom.

(4) Bath is comparatively shallow and large surface exposed to receive heat (bath depth approximately 6 in. in 1500-lb. furnace).

(5) Furnace has normally a reducing atmosphere, which may readily be made neutral or oxidizing.

(6) Automatic control of power, requiring little attendance.

(7) Furnace atmosphere free from contaminating gases.

(8) Dead atmosphere practically restrained from escape exists normally in furnace.

(9) Temperature controllable, so that slags do not

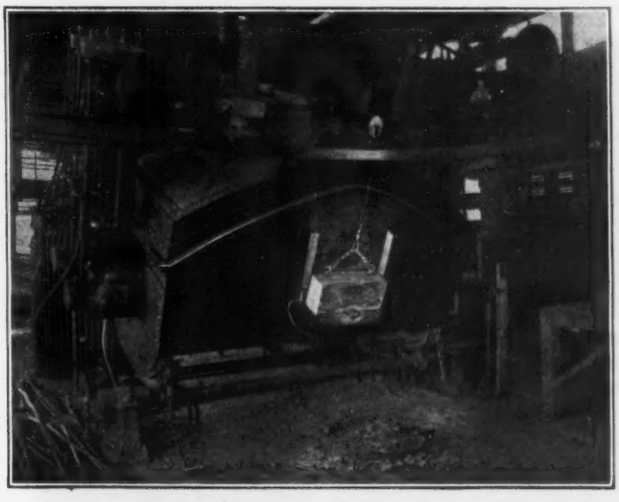


FIG. 3—1500-LB., 300-KW. BRASS-MELTING FURNACE IN OPERATION

form in melting brass; hence simplicity of metal recovery from dirt skimmed from top of bath in furnace.

(10) Furnace may be "forced"; *i.e.*, heat may be fed to metal as fast as it is absorbed, and a high rate of melting results, with all its advantages and none of the disadvantages met with in fuel-fire furnaces.

(11) Dependability of furnace and continuity of operation under commercial conditions are illustrated

in Fig. 2. The delays here due to the furnace are of short duration when compared to the time the furnace was delayed because of foundry conditions. In other words, little melting capacity was here lost and chargeable to the furnace as compared to that lost from delays for which the foundry alone was to blame.

Cost of Electric Melting vs. Fuel-Fired Furnaces.—Attention is now directed to certain characteristics and losses which influence the over-all cost of melting and must be considered in making up true melting costs. (See tabulation of costs in Table V.)

SOURCES OF METAL LOSS IN MELTING

	Electric	Fuel-Fired
(1) Temperature control.....	Excellent.....	Indifferent
(2) Size of charge.....	Controllable.....	Controllable
(3) Gas flow from furnace....	Negligible.....	Large volumes if combustion gases must pass out
(4) Furnace atmosphere; chemical condition.....	Free from oxygen and injurious gases	Contaminated by impurities of fuel; protection against oxygen only through excess fuel supply
(5) Speed of melting.....	Much greater than fuel fired	Much less than electric

The above tabulation is a statement of the principal losses in melting brass alloys. It will be noted that conditions are under absolute control in the case of the electric furnace, whereas in fuel-fired places the control is not so good.

First Source of Loss in Melting.—In a given electric furnace the weight of metal lost in melting increases as the temperature for forming alloy lies above the melting point of the alloy.

As illustrating how lack of temperature control may increase metal losses in melting brass, the following test is presented: First, 70:30 brass was made in the electric furnace, taking 420 lb. (190 kg.) of copper and

TABLE I—RESULTS OF MELTING TEST

Yellow Brass Metal, Lb.	Temperature of Alloying	Pouring Temperature	Alloy Recovered, Lb.	Per Cent Zn Loss	Per Cen Metal Loss
(a) 420 Cu 180 Zn	1170° C. 2140° F.	1150° C. 0050° C.	565	19	5.8
(b) 420 Cu 180 Zn	1100° C. 2010° F.	1100° C.	590	5.6	0.6
(Chemical Analysis, Test Corresponding to Above)					
(a) Cu 70 Zn 30	1170° C.	1150° C.	Cu 75.9 Zn 24.1	24	7.3
(b) Cu 70 Zn 30	1100° C.	1100° C.	Cu 71.3 Zn 28.7	5.5	1.6

melting down and then adding 180 lb. (80 kg.) of zinc, at 1170 deg. C., pouring at 1150 deg. C.; second, 420 lb. (190 kg.) of copper was melted down and 180 lb. (80 kg.) of zinc added at 1100 deg. C. and pouring at 1100 deg. C. with the results given in Table I. The results in this table show the narrow limits of temperature within which these operations should occur.

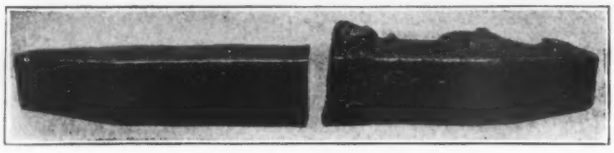


FIG. 4—BAR MADE FROM SCRAP COPPER IN ELECTRIC FURNACE—EFFECT OF SULPHUR ABSORPTION AT RIGHT

Second Source of Loss in Melting.—The weight of metal lost on melting is independent of the charge in a given electric furnace, free from ventilation.

Third Source of Loss in Melting.—In the fuel-fired furnace the magnitude of loss from this source is influenced by the speed of melting pressure and volume and the velocity of gases flowing over the melting metal. Thus increasing the atmospheric pressure in the furnace and decreasing the volume and velocity of the gases

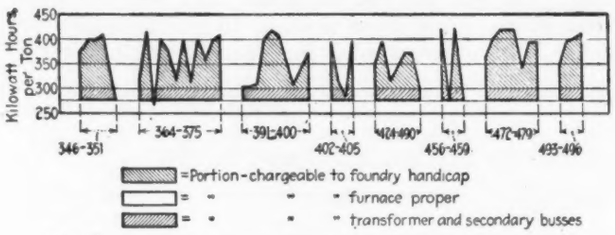


FIG. 5—ENERGY CONSUMPTION OF ELECTRIC FURNACE

Hearth capacity, 2000 lb.
Melting rate, 1700 lb. per hour.
Dirt skimmed from furnace, 107 lb. per ton.
No relining or patching during period of these tests.

tends to reduce volatilization loss. For each fuel there is a maximum limit to gas speed or velocity through the furnace, since each fuel in developing the required heat units to get the heat out at a given speed must develop a certain volume of gases which must pass out. Hence proper gas velocity is inseparably connected with products of combustion results from various fuels. The approximate volume of flue gases averages in coal, coke and oil furnaces from 3350 cu.ft. to 5800 cu.ft. per 100 lb. (2.1 cu.m. to 3.6 cu.m. per kg.) of metal melted. Hence it is easy to see how the flow of gas may bring about a very large volatile loss in the fuel-fired furnace. In the electric furnace the gas flow is very small, and consequently, though its atmosphere be saturated with metal vapors, so little gas leaves the furnace during the melt that loss is negligible.

Fourth Source of Loss in Melting.—Copper, zinc, tin and lead, the constituents of commercial brasses, are all very readily oxidizable at the temperatures to which they must be heated for melting and pouring. Oxidizing results in loss of metal and actually burns the metal to a dross. One can readily maintain a neutral or reducing atmosphere in the electric furnace, but it is certain that carbon monoxide must be so high and oxygen so low that one cannot, in ordinary fuel furnaces, hope to maintain a reducing atmosphere without sacri-

TABLE II—NON-FERROUS METALS MELTED IN ELECTRIC FURNACE

Metal	Condition of Metal Charged	State of Metal After Melting	Kw.-hr. per Ton to Melt	Metal Loss in Melting
Copper	Electrolytic cathode Pig Scrap—heavy Scrap—light Scrap—dirty Chips—oily Chips—clean	Pig at pitch without rabbling or poling Wire bar Foundry castings	300 to 500	No oxidation, a certain amount of copper oxide is reduced
Zinc	Electrolytic cathode Pig Punchings Chips Heavy scrap	Pig Foundry castings Billets for rolling Battery electrodes	90 to 120	Dross and oxidation under 2 per cent
Nickel	Shot Bar Scrap	Pig Foundry castings Billets for rolling	500 to 750	No oxidation loss
Aluminum	Pig Scrap Punchings Turnings	Pig Foundry castings Billets for rolling	400 to 750	Less than 1 per cent oxidation
Tin	Bar Pig Scrap	Bar Pig Wire	40 to 60	No oxidation
Lead	Pig Scrap Sheet	Billets for rolling Casting Pig	20 to 40	No oxidation

ficing many heat units through burning carbon to CO instead of CO_2.

GAS ABSORPTION

Gas absorption is proportional to the temperature and the time metal is held in contact with gases. Incidental and intimately connected with oxidation of metal is the absorption of gases. In melting the constituents of an alloy a gas may enter into chemical union with some of its metals, forming oxides, or they may be occluded in the alloy. Absorption of gases is greater as the temperature increases, since, when the metals freeze, absorbed or dissolved gases are given up; if they are unable to pass through the metal before it freezes, sponginess and blow-holes in the alloy will be produced. All fuels used in the foundry at the present time contain sulphur in some degree. This sulphur is a very common cause of trouble. Melted brass absorbs sulphur greedily and gives it up upon cooling in the sand molds, thus causing porosity and blow-holes to be formed. One successful brass foundry asserts that many of the failures usually attributed to oxygen are really due to sulphur. In the most careful crucible melting in coke-fired furnaces the metal will absorb 0.002 to 0.005 per cent sulphur (see Fig. 4). Sulphur accumulates in a metal every time it is melted, which accounts for the dark skin of rerun castings as compared with first-melt metal. In fact, even though melted under a charcoal cover and CO blanket, copper needs a deoxidizer to free it completely from oxygen. These troubles should not occur in connection with electric melting, since the furnace chamber may be kept uncontaminated and free from oxygen and injurious gases.

TABLE III—NON-FERROUS ALLOYS MELTED IN ELECTRIC FURNACE

Metals	Condition of Metal Charged	State of Alloy After Melting	Kw.-hr. per Ton to Melt	Metal Loss in Melting
Red brass:				
Cu 80 Zn 10 Sn 6 Pb 4	Scrap—pig, electrolytic cathode Scrap—bar Scrap—pig	Foundry castings Wire bar Billets	250 to 400	0.25 to 0.7 Depends upon manipulation of furnace
Yellow brass:				
Cu 60 Zn 39.5 Pb 00.5	Scrap—pig, electrolytic cathode Scrap—pig	Foundry castings Wire bar Billets for rolling	220 to 350	0.50 to 1.5

TABLE IV—NON-FERROUS ALLOYS MELTED IN ELECTRIC FURNACE

Alloy	Condition of Alloy Charged	State of Alloy After Melting	Kw.-hr. per Ton	Alloy Loss	Temperature, Deg. C.
Red brass	Yellow brass and copper or red brass and zinc, pig, scrap, sprues, turnings and chips	Foundry castings Wire bar Billets	225 to 300	0.15 to 0.50	1300
Yellow brass	Red brass and zinc or yellow brass and zinc, pig, scrap, sprues, turnings and chips	Foundry castings Wire bar Billets	200 to 275	0.40 to 1.00	1100
Copper	Scrap and billets	Foundry castings	500 to 750	No oxidation	1600
Nickel		Billets			
Aterite: Cu Ni Zn	Sprues, scrap Virgin metal	Foundry castings Billets for drawing and rolling	500 to 750	2 per cent zn loss out of 32 per cent	1650

TABLE V—AVERAGE COST OF MELTING BRASS WITH FUEL-FIRED OR ELECTRIC FURNACE

Furnace type	Pit	Pit	Tilting	Pit	Reverb.	Pit	Tilting	Crucible	Crucible	Tilting	
Furnace draft	Natural	Forced	Forced	Natural	Natural	Forced	Forced	Burner	Burner	Electric	
Furnace fuel	Coke	Coke	Coke	Coal	Coal	Oil	Oil	Natural gas	City gas	Electric	
Fuel cost price	9.75	9.75	9.75	8.00	8.00	0.098 gal.	0.098 gal.	0.30 M	0.60 M	0.015	kw.-hr.
COST PER TON MAKING RED BRASS. Pouring at 1300 deg C. (Zinc 10 per cent or less.)											
Fuel quantity	1400	700	600	1200	900	50 Gal.	60 Gal.	4800	7000	400 kw.-hr.-10 hr. 250 kw.-hr.-24 hr.	
Metal loss	70	30	30	70	124	30	44	45	40		15
Fuel cost	$6.82	$3.41	$2.92	$4.80	$3.60	$4.90	$5.88	$1.44	$4.20	$6.00	$3.75
Zinc value at 10c. lb.	7.00	3.00	3.00	7.00	12.40	3.00	4.40	4.00	4.00	1.50	1.50
Cost reclaiming	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.15	0.15
Renewals and repairs	0.40	0.40	0.35	0.40	0.50	0.50	0.50	0.35	0.30	1.00	1.00
Cost preheating crucible	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.10	0.10
Furnace labor	2.25	2.25	2.25	2.25	1.50	2.25	1.50	2.25	2.25	1.00	1.00
Miscellaneous and labor and fuel	0.50	0.50	0.50	0.50	0.50	0.40	0.40	0.40	0.40	0.20	0.20
Cost charcoal	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.05	0.05
Air for blast	....	0.15	0.15	....	....	0.15	0.15	0.15	0.15	....	....
Crucible cost	5.00	5.50	5.50	5.00	....	8.00	....	8.00	8.00	....	....
Interest crucible stock	0.10	0.10	0.10	0.10	....	0.10	....	0.10	0.10	....	....
Lining pouring crucible	....	....	0.30	....	0.30	....	0.30	0.30	0.30	0.30	0.30
Electrodes and coke	....	....	....	....	....	....	....	....	....	0.60	0.60
Cost per ton—total	$23.09	$16.33	$16.09	$21.07	$19.82	$20.32	$13.85	$18.01	$20.72	$10.90	$8.65
COST PER TON MAKING YELLOW BRASS (Zinc 10 to 40 per cent)											
Fuel quantity	1000	600	400	700	400	40 gal.	45 gal.			350 kw.-hr. 10-hourday	220 kw-hr. 24-hourday
Metal loss	100	40	56	100	200	60	70			30	
Fuel cost	$4.88	$2.92	$1.95	$2.80	$1.60	$3.92	$4.41			$5.25	$3.30
Zinc value at 10c. lb.	10.00	4.00	5.60	10.00	20.00	6.00	7.00			3.00	3.00
Cost reclaiming	0.50	0.50	0.50	0.50	0.50	0.50	0.50			0.15	0.15
Renewal and repairs	0.40	0.40	0.35	0.40	0.50	0.50	0.75			1.00	1.00
Cost preheating crucible	0.40	0.40	0.40	0.40	0.40	0.40	0.10			0.10	0.10
Furnace labor	2.25	2.25	2.25	2.25	1.50	2.25	1.50			1.00	1.00
Miscellaneous and labor and fuel	0.50	0.50	0.50	0.50	0.50	0.40	0.40			0.20	0.20
Cost charcoal	0.12	0.12	0.12	0.12	0.12	0.12	0.12			0.05	0.05
Air for blast	....	0.15	0.15	....	....	0.15	0.15			....	....
Crucible cost	4.50	5.00	5.00	4.50	....	4.50	....			....	....
Interest crucible stock	0.10	0.10	0.10	0.10	....	0.10	....			....	....
Lining pouring crucible	....	....	.30	....	0.30	....	0.30			0.30	0.30
Electrodes and coke	....	....	....	....	....	....	....			0.60	0.60
Cost per ton—total	$23.65	$16.34	$17.22	$21.57	$25.42	$18.84	$15.23			$11.65	$ 9.70

Fifth Source of Melting Loss.—Loss of zinc is proportional to the temperature and the length of time metal is held at the high temperature. This statement means that if one charge is melted at the rate of 100 lb. (45 kg.) per hour, and a second charge at the rate of 200 lb. (90 kg.) per hour, then, all else being the same, the melting loss of the second charge will be less than that of the first charge. Electric methods of melting lend themselves to much higher melting rates than with fuel-fired furnaces, *viz.*: Melting rate, electric, 1500 lb. (680 kg.) per hour; fuel-fired, 1500 lb. in two and one-quarter hours; 600 lb. (270 kg.) electric, one-half hour; fuel-fired, 600 lb. (270 kg.) in three hours.

Metal loss in melting is ordinarily best judged from chemical analysis of metal charged. This test eliminates errors arising from furnace-wall absorption or the reverse, also from losses in pouring. Extensive tests show the inconsistency of the actual-recovery method of loss determination.

TABLE VI—AVERAGE MELTING RESULTS REALIZED IN THE AVERAGE FOUNDRY WITH FUEL-FIRED FURNACES

Type	Furnace Draft	Kind Fuel	Fuel Burned, per Ton	Metal Loss, per Cent	Kind Brass
			Lb.		
Pit	Natural	Coke	1400	3.5	Red
			1000	5	Yellow
Pit	Forced	Coke	700	1.5	Red
			600	2	Yellow
Tilting	Forced	Coke	600	1.5	Red
			400	2.8	Yellow
Pit	Natural	Coal	1200	3.5	Red
			700	5	Yellow
Reverberatory	Natural	Coal	900	6.2	Red
			400	10	Yellow
			Gal.		
Pit	Burners Tangential	Oil	50	1.5	Red
			40	3	Yellow
Tilting	Open-flame Atomizing Burners	Oil	60	2.2	Red
			45	3.5	Yellow
			Cu.Ft.		
Tilting Crucible	Burners Tangential	Natural gas	4800	2.75	Yellow
Tilting Crucible	Burners Tangential	City	7000	2.75	Yellow

* Low zinc, 10 per cent; high zinc, 10 per cent above.

A tabulation of physical tests of metal produced from an open-flame oil furnace and from an electric furnace melting the same brass follows:

	Electric Furnace	Oil Furnace
Tensile strength	27,900	24,969
Yield point	10,844	9,850
Elastic limit	7,300	7,000
Elongation in 2 in., per cent	19.4	16.9
Elongation in 8 in., per cent	17.2	14.9
Reduction of area, per cent	21.4	19.7

Likewise the physical properties of brass melted in an electric furnace appear to be better than those produced in a crucible furnace:

	Crucible Furnace	Electric Furnace
Tensile strength	30,250	30,820
Elastic limit	17,833	18,000
Elongation, per cent	16.14	19.37
Reduction of area, per cent	16.1	22

PERFORMANCE OF ELECTRIC FURNACES

Tables II, III and IV show performance on the average to be expected from the use of the electric furnace with the furnace charge in different physical forms. Table VI shows like results for fuel-fired furnaces.

The results given in Tables I to IV are average figures and will be influenced to meet any particular foundry by, (a) promptness of pouring; (b) temperature (since pyrometers are seldom used); (c) local conditions, such as physical condition of metal charged, its cleanliness, volume of air and products of combustion which pass through the furnace in natural-draft furnaces—this varies from day to day, depending on the weather; (d) design of furnace; (e) manipulation of furnace; (f) size of crucible; (g) percentages of composition; (h) length of working day; (i) whether observations are based on hot furnace and hot crucibles or whether first heat of the day is excluded; (j) pouring light castings requires hot metal, and pouring heavy ones metal at lower temperature; (k) whether results are from careful tests or whether they represent actual foundry or rolling mill practice and extend over a considerable period.

COST OF MELTING BRASS IN FUEL-FIRED AND ELECTRIC FURNACES

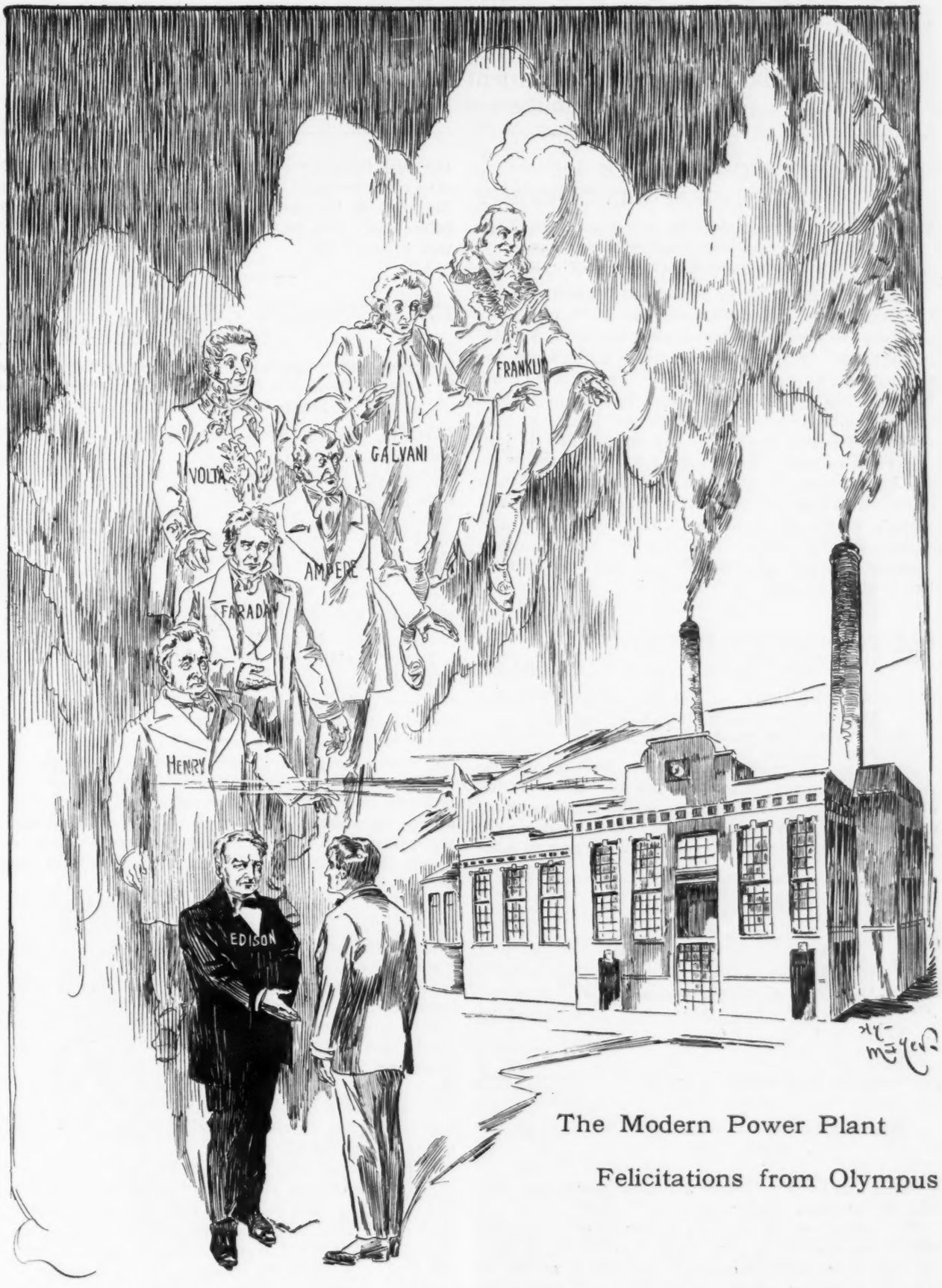
Table V is a résumé of the statements contained in the paper relating to cost of melting brass per ton with the various typical fuel-fired furnaces and also with the electric brass-melting furnace. This table is an average table, and results for individual foundries may be readily found by substituting in the itemized costs those of the factory concerned; *i.e.*, 1.5 cents per kilowatt-hour has been used as electricity or power cost, but if the cost in the plant under consideration is 1 cent, then this figure should be substituted. In the same manner other values may be converted to actual ones for an actual local condition. It is believed that the values used in this table are fair and represent well-averaged conditions, and they may be considered directly without substituting for local conditions; in fact, in their direct form they permit a correct judgment of the general problem of electric versus fuel-fired furnaces.

Comparing the results if all the brass in the country were melted, (1) in fuel-fired furnaces, all types being employed equally, or (2) in electric furnaces, the saving from the employment of the latter would be as follows:

Alloy Melting	Length Working Day, Hours	Per Cent Savings Over Fuel-Fired, per Cent
Yellow brass	10	100
Red brass	10	80
Yellow brass	24	110
Red brass	24	700

These margins of savings are of such magnitude that it can no longer be doubted that the electric furnace is destined completely to dominate the brass-melting field.

DON'T let us forget the peril we have been in. It may arise again at a moment's notice. We must have a large and thoroughly trained standing army. We must have universal military training, both of a combatant military type and for the business end of the war. And we must arrange from this time forward that there be a close sympathetic liaison between the regular army officer and the so-called captains of industry. We must understand each other, respect and recognize our mutual dependence. We must obtain a better view of the regular army organization, and the regular army must learn something from the business man.—*Lieut.-Col. H. M. Byllesby.*



The Modern Power Plant

Felicitations from Olympus

From the Daily published by the ELECTRICAL WORLD for the National Electric Light Association convention

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

METER-TESTING PRACTICE OF MINNEAPOLIS COMPANY

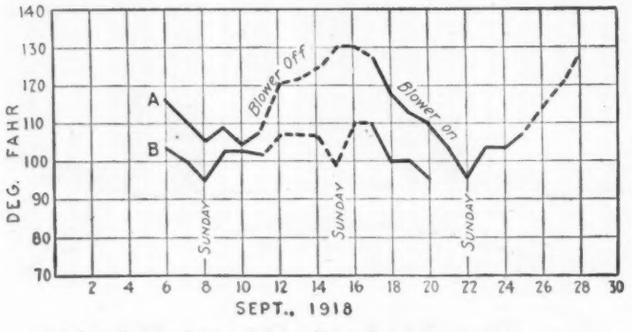
Testers Do Not Repair Meters, and Each Man Tests from Ten to Fourteen Single-Phase or Four or Five Polyphase Meters a Day

George M. Hewitt of the Minneapolis General Electric Company stated recently that those of his company's men who are engaged in testing are required to do nothing but that. When a meter is found out of order the tester does not repair it because the time required could be utilized to test one or two more meters. As a result the alternating-current meter tester averages from twelve to fourteen meters per day continually. In testing polyphase meters he averages four or five meters per day in size ranging from 5 amp. to 80 amp., including transformer types. Each man working on large direct-current meters in sizes from 100 amp. to 300 amp. usually tests from five to six per day and on meters ranging from 600 amp. to 1200 amp. will average from two to three complete tests per day.

BLOWERS INCREASE RATING OF UNDERGROUND CABLES

Forced-Air Circulation Is Shown to Have Reduced Manhole Temperature 15 Deg. Fahr. and Duct Temperatures Even More

Operators of underground distributing systems realize that operating temperature limits the rating of cables the same as it does the rating of other pieces of electrical apparatus. Temperature surveys are therefore being carried out on many underground cable systems, and artificial means are sometimes used to reduce the ambient temperature.



EFFECT OF BLOWER AND DECREASED SUNDAY LOAD ON CABLE TEMPERATURES

The results which may be expected when a small blower operated by a 1-hp. motor is used to circulate air rapidly through an ordinary manhole is shown by the curves in the attached diagram. "A" shows the effect on the temperature recorded by a thermometer in the duct line 10 feet (3 m.) from the manhole. "B" shows the decrease in the temperature recorded near the roof of the manhole. The cooling effect on the cables due to the decrease in the load on Sunday is also well brought out.

EXTINGUISHING FIRES IN TURBO-GENERATORS

Armature Windings Saved by Shutting Off Air and Filling Generator Casings with High-Pressure Steam When Fire Occurs

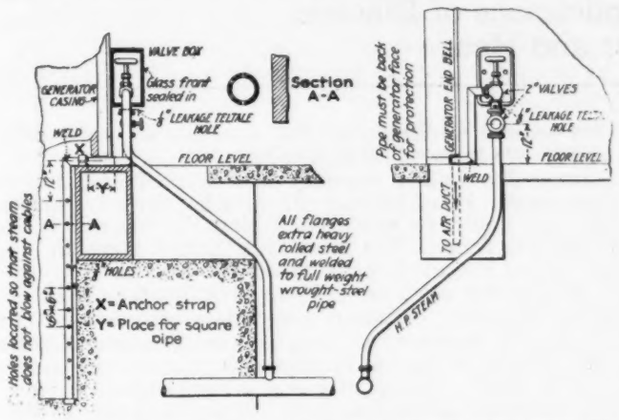
The Duquesne Light Company of Pittsburgh, Pa., has made provision in every one of its turbo-generators for extinguishing fires by the use of steam at boiler pressure. This action was occasioned by a number of fires which started in the stator windings of the machines after heavy overloads, short circuits or line surges. Some of these fires necessitated the reinsulation of the entire armature windings, but since high-pressure steam has been made available fires have been extinguished before the insulation of the windings has become seriously damaged.

Before deciding on the use of steam as a fire extinguisher, carbon tetrachloride, carbon dioxide and water were also considered. The final choice, however, rested between steam and water. If water were used, it would have to be poured over the windings and it might not reach the point in the windings where the fire originated. Furthermore, the water would have to be removed after the fire was extinguished, and it would hardly be practicable to start up the machine again without at least an examination and test. These are among the considerations which led to the use of high-pressure steam.

The heat of the steam at boiler pressure has no deleterious effect on the insulation of the armature coils. The steam penetrates to every part of the winding where there could possibly be a fire and it leaves no unpleasant consequences. Steam used for extinguishing burning armature insulation has put out fires so quickly that it has been possible in emergency to put the machines back on the line after a fire without either shutting down the steam end or making an examination of the windings. This action was necessitated when a fire occurred during the system peak because the Duquesne Light Company carried a load in excess of its plant rating during the war.

It is essential that the steam be taken from a line which will always be alive when the turbine is running. The connection must be tapped into the top of the steam header and taken up to the control valves without making any trap in which water might collect. Two valves are used, one above the other, as an extra precaution to prevent leakage, but only the upper valve is inclosed in an iron case with a glass front. A ⅛-in. (3-mm.)

hole is drilled at the back of the pipe between the two valves so that any steam leakage through the first valve would escape and attract the attention of the operators. Sufficient steam is turned into the generator casing to



CONNECTIONS FOR STEAM FIRE EXTINGUISHER INSTALLED IN TURBO-GENERATOR

keep back any air which might otherwise leak past the closed dampers.

Enameled iron signs with instructions in white letters on a red background are placed above the fire extinguisher valves at each generator. The instructions in case of fire are as follows: (1) Have generator cut off the line immediately. (2) Cut off field excitation. (3) Close damper on air duct. (4) Break glass and open steam valves. (5) After two minutes shut off steam. If smoke continues to show, turn steam on again for two minutes and repeat this process until fire is completely extinguished. (6) Keep turbine running without load until satisfied that fire is extinguished and the generator is cooled. (7) Remove end bells and make thorough inspection.

ECONOMICAL BRASS MELTING IN ELECTRICAL FURNACES

Although Induction Furnaces Are Recognized as Inherently Efficient, Brass May Be Produced as Economically in Larger Units

An electric furnace in which the heat is supplied from carbon electrodes immersed in a bed of coke is described by E. F. Collins in a paper entitled "Melting of Non-ferrous Metals and Alloys," an abstract of which appears elsewhere in this issue. In dealing with the cost of melting brass in this furnace Mr. Collins compared its performance with that of the well-known induction type. He stated that, although the induction furnace is economical of electrical energy, the cost per ton of brass should be no less than the cost of production in the furnace described by him on account of the low attendance cost of the latter.

In the course of his discussion Mr. Collins said:

"Considering the induction furnace, this type is said to be exceptionally efficient thermally during melting. We shall see, however, that its over-all working efficiency for the week is not appreciably different from furnaces under consideration, and it is desired to call attention to the fact that the kilowatt-hours per ton consumed in melting may by no means indicate the highest over-all working efficiency. Suppose, for illustration, we concede that the induction type of furnace has the highest thermal efficiency in melting. A certain furnace of this type has a crucible capacity of 400 lb. (180 kg.) and no-load loss or radiation of 8 kw.-hr. per hour and melts a charge of red brass each hour. Suppose charge is poured at 1300 deg. C.; it is necessary to use hand ladles preheated in pouring the charge. The furnace must be kept hot twenty-four hours per day when the crucible has once been heated up. Let comparison be made between the effective working kilowatt-hour consumption per ton and that of a 2250-lb. (1020-kg.) per hour tilting-type furnace of the design described and melting 18,000 lb. (8160 kg.) of red brass per eight-hour day. It will be noted that this furnace may be charged by machine, whereas the crucible furnace must be carefully charged by hand. One man's labor will operate—*i.e.*, charge and melt this metal—say at $4.50 per day, or for $1 per ton labor. Pouring of charge will be by hand ladle preheated and should cast the same as pouring a like quantity from crucibles.

"It seems that since five to six 400-lb. (180-kg.) crucible furnaces must be employed to give the same metal output as one 2250-lb. (1020-kg.) tilting furnace, the labor of attendance for charging and melting should cost at least two and one-quarter times as much in the crucible furnace as in the tilting-hearth type, or $2.25 per ton. It follows from above that:

Metal melted per week in 400-lb. crucible induction furnace, eight-hour working day = 19,200 lb.

Kw.-hr. to melt 19,200 lb. at 200 kw.-hr. per ton = 1920 kw.-hr.

Kw.-hr. to keep furnace hot while not melting, 120 hours per week = 960.

Total kw.-hr. per week = 2880.

Kw.-hr. per ton = 2880 ÷ 9.6 = 300.

Power cost per ton at $0.01 = $3.00.

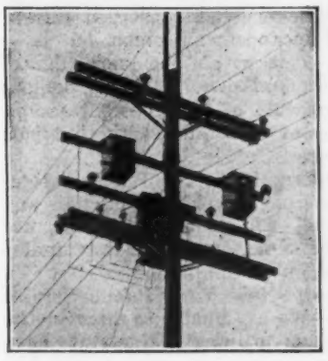
Excess labor cost of 400 lb. crucible furnace over 2250 lb. tilting hearth per ton = $1.25.

Total cost = $4.25.

"If the large tilting furnace melts with the not unexpected consumption of 425 kw.-hr. per ton, it will have equaled the performance of the induction crucible furnace, which, off-hand, seems much more efficient because it is said to melt for 200 kw.-hr. per ton. Large-capacity induction furnaces might change the above, but I do not know of any successful design for melting brass in capacity exceeding 600 lb. (270 kg.). In fact, these are limited to certain mixtures only. Leaded brass above 3 per cent, I believe, cannot be successfully handled owing to fluxing action on crucibles."

Standard 13,200-Volt Pole Service Connection

One of the utilities of the Central West taps its 13,200-volt lines to supply 115-230-volt secondary service to its small customers adjacent to its right-of-way. The illustrattion shows the top of one of the poles where such a connection has been made for a house. The secondaries are about 8 ft. (2.5 m.) below the primary line, and it will be noted that the transformer is protected by two expulsion fuses mounted above it. The back of the pole is always kept clear for the lineman.



CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

DAYLIGHT SAVING AND WAR RULES IN BOSTON

How These Affected the Edison Electric Illuminating Company of That City—Revenue Loss and Saving in Coal

The Edison Electric Illuminating Company of Boston estimates that owing to the daylight-saving law in the calendar year 1918 it saved 4420 long tons of coal, suffered a reduction in gross revenue of $350,000, generated 5,000,000 kw.-hr. less and sold 3,500,000 kw.-hr. less. Because the daylight-saving law was not in effect during November and December, 1918, the maximum demand of all customers upon the system—*i.e.*, the company's peak—was not affected. The aggregate of the maximum demands and the average of the demands of most customers was probably reduced, but to what extent it is impossible to estimate with any exactness. The company estimates that because of war regulations (lighting restrictions, "workless days," etc.) in effect during the period from Nov. 9, 1917, to Nov. 23, 1918, it saved 5450 long tons of coal, generated 6,200,000 kw.-hr. less, sold 4,700,000 kw.-hr. less, and suffered a reduction in revenue of $175,000.

FREE LAMP RENEWALS NOT PROHIBITED BY COMMISSIONS

Reports that Action Had Been Taken Regarding Incandescent Lamps Are Denied by New York, Maryland and New Jersey

Reports have been in circulation that various state public service commissions have prohibited the free renewal of incandescent lamps. These reports mentioned the commissions of New York, Maryland and New Jersey. In answer to inquiries from the ELECTRICAL WORLD the following denials were received from these companies:

A. N. Barber, secretary New Jersey Board of Public Utility Commissioners—There has been no law enacted in New Jersey which prohibits electric light companies making free renewals of incandescent lamps. The public utility act forbids a public utility making or giving "directly or indirectly any undue or unreasonable preference or advantage to any person." Possibly some one has construed this as preventing free renewals of incandescent lamps, but if so such a construction has not come within the knowledge of the Board of Public Utility Commissioners. If all persons are treated alike in the renewals of incandescent lamps, such renewals would not appear to conflict with that portion of the statute quoted above.

Benjamin T. Fendall, secretary Maryland Public Service Commission—This commission has never promulgated any rules prohibiting free renewal of incandescent lamps, nor has it any rule permitting the same, nor has it ever undertaken to pass upon the question of lamp renewals.

Francis X. Disney, secretary New York Public Service Commission, Second District—We are unable to discover the source of the current report that utilities in this state have been ordered to discontinue free renewals of incandescent lamps. We know of no such order.

James B. Walker, secretary New York Public Service Commission, First District—The Public Service Commission has issued no order prohibiting the renewal of incandescent lamps. The New York Edison Company and the United Electric Light & Power Company prior to July 1, 1918, had a provision in their schedule of rates as follows: "Lighting customers may obtain their lamps from the company in two ways: first, by direct purchase at prices listed below, or second, by signing a lamp-service agreement in which a charge of ½ cent a kilowatt-hour is made, the amount to be based upon the current consumption registered on the meter through which the lighting installation is supplied. This service includes the supply of 'mazda' lamps of 50 watts and larger size without added cost and of corresponding lamps of smaller size at a slight additional charge." This lamp service rider was canceled by the company on thirty days' notice to the commission, in accordance with the provisions of the Public Service Commission law in the matter of filing electrical rates, and became ineffective on July 1, 1918.

CHANGING FROM STEAM TO HYDROELECTRIC POWER

Problems Solved in Changing System of Approximately 2000 Kw., Steam-Operated, 60-Cycle, to Water Power, 50-Cycle

BY W. E. BODEN
Electrical Foreman Santa Barbara (Cal.) Gas & Electric Company

The electric distributing system of the Santa Barbara Gas & Electric Company in the past has been supplied with power from a 60-cycle, 2000-kw. steam plant situated on the ocean front at Santa Barbara. For several years the load on the Santa Barbara system has increased quite rapidly, and it became necessary either to go to considerable expense installing additional steam generating units or to arrange for delivery of power from a transmission system. The present-day high cost of oil was the principal consideration in the determination to connect up with a transmission system.

Contract was accordingly entered into between the Santa Barbara Gas & Electric Company and the Southern California Edison Company, whereby the latter agreed to build a 60,000-volt transmission line from its Saticoy substation to the Santa Barbara County limits, near Carpinteria, a distance of about 19 miles, and the Santa Barbara Gas & Electric Company to build a transmission line from this point to the Santa Barbara steam plant, 21½ miles, and there install the necessary transformers and other equipment to step down the power from 60,000 to 2400 volts.

After a careful study of the difficulties involved, it was decided to change over all consumers' installations so as to receive 50-cycle service rather than to install a frequency changer to convert the 50-cycle service from the Edison system to 60 cycles for delivery to the Santa Barbara system.

In order to get an outline of the changes necessary to adopt the consumers' apparatus to 50-cycle service, a man was sent out with a list of all power consumers, routed by streets as listed on the power register. This man filled out a card giving the pulley sizes of all motors, including diameter, face, bore and keyways where belt drives were employed, or pitch, number of teeth, face, bore, keyways, as well as material, where gears were employed. In addition to this, all name-plate data of motors were carefully listed, with a description of driven apparatus with sizes of pulleys and general operating conditions. When this work had been completed a numbering machine was employed to give these cards a serial card number.

It was thought that pulleys could be changed from one location to another, but a study of the completed cards disclosed the interesting fact that only two pulleys out of more than 400 installations were of the proper dimensions to use without alterations, and inasmuch as a large proportion of these pulleys were thin cast-iron pulleys which could not be altered, it was deemed advisable to order paper pulleys to be installed for all motors.

The dimensions of the pulleys required were listed on the order, and the manufacturer was given the card number of each and instructed to attach a tag to each pulley bearing this card number. These pulleys were in the Santa Barbara warehouse before the change was started. All other parts were also shipped to Santa Barbara with card number attached. After the pulleys were obtained, the cards were further classified—*i. e.*, chain drives, gear drives, direct connections, motor-generator sets, pumps, organ blowers, etc.—in order that special consideration could be given to this class of apparatus.

As it was planned to change over one circuit at a time, the locations of consumers were listed by circuits, with the card number opposite each name in order to identify any material in the warehouse intended for this location. When the first circuit was changed the working force went out with all pulleys and changed them in index order; but this was found to cause considerable confusion and to create a great many imaginary troubles, and it was found to be much more practicable to change a circuit without notice to consumers except in cases where it was actually known that trouble would develop, and in all other cases to make the changes as complaints were received.

War Conditions Hampered the Work

We were hampered to some extent by the fact that the change was made while the nation was engaged in the war, and it was not possible to obtain certain materials for prompt delivery; but in these cases directly connected units could usually be operated temporarily by belt drive. This was particularly true of directly connected centrifugal pumps. These were all of the horizontal type, and they were temporarily belted until new pump bowls with impellers of proper diameter could be obtained. These bowls were mounted on the original pump base, using the same motor as before the change.

There were quite a number of both single-stage and multi-stage pipe-organ blowers, and these were fitted for 50-cycle speed in most cases by increasing the diameter of impellers to give the same peripheral velocity; but in some instances the small clearance between impellers and case would throttle the outlet and prevent an ample flow of air. In these instances a motor of higher speed was used and the diameter of impellers reduced, or in multi-stage fans one impeller would be removed.

The most expensive changes were on rotary oil burners for heating systems. These operate on the principle of centrifugal force and were geared to the motors. The speed reduction materially affected the proper combustion of fuel, and it was necessary to change all gears and gear cases before satisfactory results could be obtained.

As this system is on the edge of an extensive 50-cycle territory, where nearly all motors are furnished with good operating characteristics on 50 cycles, we had no difficulty with those above 1-hp. capacity; but small motors on washing machines and similar apparatus where motors are not standard but are designed cheaply for that special duty had to be replaced by standard 50-cycle motors.

There were quite a number of small single-phase motors of ¼ hp. and ½ hp. with which trouble was experienced, but these were usually found to be operating with considerably less than full load, and where a number were being supplied from one service an auto-transformer was employed to reduce the voltage in the same proportion as the frequency was lowered. This resulted in practically the same characteristics as were formerly found on 60-cycle service, and in many cases the results were improved. This same practice was applied to small dental motors and motors used on medical apparatus. These auto-transformers were individual units, and were furnished by the manufacturer's agents in Los Angeles, where both 50-cycle and 60-cycle systems are in use.

It was found that practically all motor-generator sets could be operated successfully on 50-cycle speed by connecting the shunt field in two parallel circuits instead of a single series as was done before the change, there being only three cases out of about thirty where it was necessary to rewind the field or armature coils.

Alternating-current elevators gave no trouble except that the magnet coils operating the contactors would slam considerably until the proper taps were used and the distance of travel was adjusted. This work was done by the manufacturers' representatives as this is a special field of operation. Aside from this, the change was made by the local force with little assistance from the outside. The whole change was made without interruptions in service except of momentary duration, and the system has been operating successfully for a period of about six months. The results fully justify the change to local 50-cycle service, which now allows any degree of expansion, with the entire generating capacity of the Southern California Edison Company's system as a reserve.

My recommendations to any company attempting such a change would be to select carefully the men to perform the work. Time must be spent, and spent freely if necessary, in order to make each apparatus work to the satisfaction of the owner, and it will be found that it is almost impossible to satisfy them all entirely. It is necessary to convince them that the company is not trying to "put something over." If compelled to exchange a motor, a good reason for so doing should be given, otherwise there will be two or three more in the same location to change. But the whole secret is, take care of the customer; attend to his wants no matter if his motor is rated at ¼ hp. or 50 hp.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

General Characteristics of Electric Ship Propulsion Equipments.—E. F. W. ALEXANDERSON.—The design of the propulsion equipment is such that all momentary power requirements are met by corresponding adjustments of the generator field excitation. The amount of field excitation that can be applied continuously determines continuous performance at full speed, and the excitation that may be given momentarily determines the momentary overload and reversing performance. The

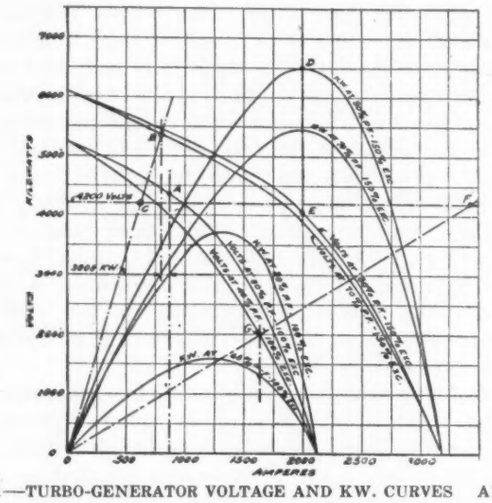


FIG. 1—TURBO-GENERATOR VOLTAGE AND KW. CURVES AMPERES AND KW. HALF OF ACTUAL GENERATOR VALUES

dependence of the power equipment upon the excitation of the generator may be seen by reference to Fig. 1, which gives the kilowatt curves when the coils are connected for high voltage and operating at 35½ cycles. Point *B* shows the volts and amperes of the motors when drawing 3000 kw. per phase at 150 per cent generator excitation; while point *F* shows the volts and amperes drawn by the motor at 4200 volts and 20 per cent slip. In order to design a motor to meet the requirements for quick maneuvering and reversal of the propellers, it is necessary to have a motor which can not only develop a considerable driving torque to the propeller when it rotates in the reverse direction, but which also has a braking effect as high as full-load driving torque in order to stop the propeller before it can be reversed. The primary winding is such that the motor may be changed from a twenty-four-pole to a thirty-six-pole motor, but with this particular winding the advantage is gained that all the conductors in the windings are active with the same efficiency as in an ordinary induction motor with one-speed winding. The characteristics of one of these induction motors operating in constant potential at 4200 volts and at 35½ cycles are given in Fig. 2.—*General Electric Review*, April, 1919.

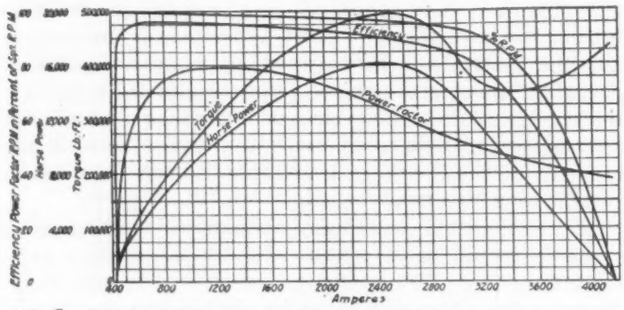


FIG. 2—CHARACTERISTICS OF INDUCTION MOTOR WITH DOUBLE SQUIRREL-CAGE WINDINGS

Theory of Asynchronous Machines with Elliptic Field.—W. GENKIN.—In dealing with the theory of Fynn the author establishes general equations for asynchronous machines and demonstrates that in all cases the problem should be reduced to the study of a single circuit replacing the combined circuits of the stator and the armature. An equivalent circuit is finally sought in the particular cases of a motor with revolving field, of a single-phase motor, of a phase connector and of an induction meter.—*Revue Générale de l'Electricité*, April 12, 1919.

High-Frequency Alternators.—MARIUS LATOUR.—An article reproduced from a communication to the French Society of Electricians. The different types of machines that are susceptible of use for the direcet generation of high-frequency currents intended to charge wireless-telegraphy antennas are described. The paper directs attention particularly to the French projects for machines which the author designates as "homopolar machines with partial utilization of the periphery" and "monopolar machines with variable reluctance."—*Revue Générale de l'Electricité*, April 12, 1919.

Generation, Transmission and Distribution

Effect of Air and Water on Materials Used in Engineering Work.—H. E. YERBURY.—The writer deals particularly with the effects of corrosion on steel, iron and non-ferrous alloys used in the construction of tanks, rotary pumps, condenser tubes, turbo-generators, economizers, turbines and other machinery found in and about the power house.—London *Electrician*, March 21, 1919.

Standardization of Cables in Germany.—New rules are published by the German standardizing committee relating to the construction and installation of electric cables. These are given in detail, but the contents are not of a nature permitting short abstraction.—*Technical Supplement Review of the Foreign Press*, April 1, 1919. (Abstracted from the *Elektrot. Zeits.*, Jan. 23, 1919.)

Failures of High-Tension Insulators.—E. PERRY.—The author gives a description of the insulators of the pin and suspension types. The special difficulties which have a bearing on the life and endurance of an insulator are outlined. The author thinks that porosity

in the porcelain is the principal cause of failure. It is suggested that the interface of the joints should be glazed; that some non-porous and non-expanding substance should be employed for jointing purposes, and if Portland cement is used for this purpose, the exposed faces should be coated with some waterproof varnish. The face of the joint between the shells should be as small as possible and set horizontally with a recess above it so as to prevent water being forced against the cement face by wind pressure, as in the present designs.—*Science Abstracts, Section B*, February, 1919. (Abstracted from *New Zealand Journal of Science*, September, 1919.)

Short-Circuit Lighting Networks.—G. GORMANN.—The V. D. E. rules require that oil switches and cut-out releases be selected on the basis of the sustained short-circuit current at the place of utilization. The V. D. E. formulas for the determination of this current are applicable only to simple cases and are based on percentage voltage drop at a given load. Actually, the voltage drop itself is proportional to the load and dependent on network constants; hence it is better to base a formula on the network constants themselves, rather than on quantities which must be determined laboriously from these constants. The V. D. E. formulas often give too high values for short-circuit current, and a new formula is here given which makes clear the influence of every part of the network on the short-circuit current.—*Science Abstracts, Section B, February, 1919.* (Abstracted from *Elektrot. Zeits.*, Nov. 7, 1918.)

Powdered Fuel for Hammersmith.—Proposed installation with diagram of layout and photograph of the pulverizing house.—*Electrical Times*, March 13, 1919.

Turbines of the U.S.S. New Mexico.—E. O. HUNT.—Two duplicate Curtis turbines directly connected to two alternating-current generators supply power for the ship drive. These are practically of the same design as turbines built for land operation by the General Electric Company. A distinctive feature, however, of these marine-propulsion turbines is their ability to operate over a wide range of speeds, and a novel scheme of governing arrangements especially designed for this application is described in some detail.—*General Electric Review*, April, 1919.

Utilization of Peat for Power Generation.—JOHN B. C. KERSHAW.—A summary is presented of the most recent experience with the utilization of peat, the subject being discussed under the following headings: (1) Composition and constitution; (2) briquetting; (3) carbonizing; (4) classifying; (5) powdered peat; (6) conclusions. The author presents a table giving the specific requirements of boilers when fired by peat.—London *Engineer*, March 14, 1919.

Oscillations in Crank Shafts.—J. MAGG.—The author investigates the conditions arising if the revolutions per minute of an engine resonate with the natural period of oscillation of the torsional spring system constituted by the shaft and flywheel. A simple method is given by means of which the resonance may be predicted and avoided. Resonance occurring temporarily during acceleration may be of minor importance, but resonance at normal speed results in excessive vibration and unsteady running. A formula is derived for the period of the oscillating system, $T = [(32\pi l\Sigma(GD^2)/d^4G_g]$. The value of T calculated from this equation must not coincide with the period of revolution of the engine (or with one-half, one-third, etc., of this period). If resonance occurs, the value of $\Sigma(GD^2)$, as first chosen from the point of view of cyclic irregularity, must be increased sufficiently to destroy the resonance. The simplification introduced into the consideration of the problem consists in reducing the crank shaft to an equivalent plain cylinder. The diameter of the latter is chosen so as to coincide with as much as possible of the actual shaft, and the length is modified as required to compensate for reductions from actual to "equivalent" diameter.—*Science Abstracts, Section B*, February, 1919. (Abstracted from *Zeits. Vereines Deutsch.*, Oct. 26, 1918.)

Installations, Systems and Appliances

Utilizing the Time Characteristics of Alternating Current.—HENRY E. WARREN.—By the invention of a very small, simple and reliable self-starting synchronous motor, in conjunction with convenient means for regulating the average frequency of an alternating circuit, there has been developed a new field of usefulness for electric power. It is now feasible to drive all kinds of timing devices such as clocks, graphic-instrument movements, time recorders, etc., directly from the lighting circuits. Remarkable accuracy is obtained, and the amount of care is minimized by the elimination of winding and regulating.—*Proceedings A. I. E. E.*, May, 1919.

Unification of Pressures in Italy.—E. SOLERI.— The great number of different pressures used in the electric generating stations of Italy is a cause of much inconvenience, as the plants are unable to assist one another. The different values of pressures below 600 volts adopted in electric installations in Italy are 240 in number. All systems are comprised in this number—direct-current, single-phase and three-phase installations. The total power distributed amounts to 813,711 kw. A table and a diagram show the relative importance of the different systems. The author is in favor of the intervention of the state only for fixing the low pressures to be adopted, the high tensions to be employed being left to be decided by the companies themselves.—*Science Abstracts, Section B*, Jan. 31, 1919. (Abstracted from *Elettrotecnica*, Dec 5, 1918.)

Starting and Controlling Switchgear for Shipyard Machinery.—A. P. PYNE.—The unsatisfactory behavior of earlier types of switchgear mitigated against the more general adoption of electric motors. Improvements gradually introduced have now made it possible to obtain reliable switchgear of many types. Care is still required in the manipulation of automatic types, otherwise excessive repairs will result. High cost and lack of confidence have prevented the more general use of automatic gear, but improved design, standardization and manufacture in considerable quantities have largely eliminated both disadvantages.—London *Electrician*, April 11, 1919.

Modern Shipyard Cranes.—CLAUDE M. TOPLIS.—For the purpose of shipbuilding a number of alternative crane systems are available. From this point of view the mast and derrick system, the double cantilever crane running on a high gantry, the overhead-bridge traveling crane, the jib crane running on a high gantry and the tower crane system are compared in this article. The author then passes on to the consideration of the

capacities of cranes and various essential features. He also discusses advantages and disadvantages of direct-current and alternating-current equipment.—London *Electrician*, April 11, 1919.

Searchlight Projector as Used in the Mercantile Marine.—R. C. HARRIS.—Searchlights used in the mercantile marine are distinct from those used in the navy and on land. The article deals with sizes in general use and with the manner in which they are designed, installed and used. Types of lamps, mirrors and lenses and also methods of remote control, both mechanical and electrical, are discussed as well as other details of searchlights.—London *Electrician*, April 11, 1919.

Use of Portable Machinery in Ship Construction.—G. F. MACKAY.—The author deals briefly with electric distribution for electrical portable plants and then passes on to describe a number of portable machines. These include the electric caravan, winches, sawing machines, electric drills and electric deck planers.—London *Electrician*, April 11, 1919.

Electric Welding Applied to Shipbuilding.—J. H. COLLIE.—After reference to the general systems of welding that are available, the author describes briefly the particular systems now mostly in use and then passes on to the question of testing electric welds. In conclusion, reference is made to recommendations by Lloyd's and the American Bureau of Shipping as to the applications of electric welding to ship construction.—London *Electrician*, April 11, 1919.

Magnetic Concentration of Pyrrhotite Ores.—J. P. BONARDI.—The author gives the results of experiments and tests made with a Wetherill-type magnetic separator with pyrrhotite ores. He states that classification is not necessary but that the ore should be stage-crushed to unlock the sulphides from the gangue. He states that a good quality of ore is economically obtained.—*Chemical and Metallurgical Engineering*, March 15, 1919.

Electrochemistry and Batteries

Electrolytic Silver and Gold Refining at Perth Amboy, N. J.—GEORGE G. GRISWOLD.—An illustrated description of refining silver bullion electrolytically by the Moebius process at the works of the American Smelting & Refining Company, at Perth Amboy, N. J. The Wohlwill plant for electrolytically refining the gold bullion and recovering from it platinum and palladium is also incidentally described.—Paper presented at the thirty-fifth meeting of American Electrochemical Society, April 3, 1919.

A Process for Electrolytically Refining Nickel.—GEORGE A. GUESS.—Impure nickel containing copper and iron is electrolytically refined, using it as an anode. Iron goes into solution and accumulates there, but copper, which also goes into solution, is precipitated therefrom continuously by keeping powdered calcium carbonate (limestone) suspended in the electrolyte. An unusual salt is thus formed from the copper in solution, completely precipitating out copper. The cathode is inclosed in a canvas bag to keep it free from mechanical impurities. Glue is used in the solution and the cathode nickel contains usually less than 0.001 per cent copper.—Paper presented at the thirty-fifth meeting of American Electrochemical Society, April 3, 1919.

Units, Measurements and Instruments

Electrical Measurement of Fluid Flow in Pipes.—JACOB M. SPITZGLASS.—Theory and development of a device embodying an ammeter and watt-hour meter and in which the electric current flowing is proportional to the quantity of fluid passing through the pipe. Diagram and sketch of electrical device and methods of determining velocity pressure are given. Also a diagram shows the relation between units of fluid flow and electric units.—*Mechanical Engineering* (journal A. S. M. E.), May, 1919.

Measurements of Small Alternating Voltages.—H. GEWEEKE.—The instrument that is described was designed to fill the need for measuring small alternating voltages with a negligible energy consumption. It consists of an electrometer with a range of 70 volts connected on the secondary side of a transformer with a ratio of 1:70, so that voltages up to 1 volt can be measured. The transformer has to be designed to work at very low saturation so that the losses may be as small as possible, and the magnetizing current is compensated by the use of a condenser. The main portion of the article is concerned with the details of the design of the transformer and the methods of testing it so as to determine the effect of change of voltage, frequency and temperature on its ratio of transformation. The instrument was found to be sufficiently accurate in its readings from 1 volt to 5 volts at frequencies of from 40 cyles to 60 cycles a second. The range can be increased or decreased by taking tappings from the secondary or primary windings. The instrument is manufactured by Siemens & Halske and by Hartmann & Braun.—*Technical Supplement*, April 1, 1919. (Abstracted from *Archiv. für Elektrotechnik*, Jan. 26, 1919.)

Miscellaneous

Molded Insulation.—W. H. KEMPTON.—The manufacture of hot molded materials and their characteristics, as well as the manufacture of cold molded materials, is discussed in order that the applications and collection of such materials may be made intelligently by the users. It is particularly urged that the engineer who has occasion to use molded insulation in his designs should visit the factory where molded insulations are made in order that he may not impose impossible or uneconomical conditions upon the manufacturer.—*Electric Journal*, March, 1919.

The Government and the Organization of Scientific Research.—FRANK HEATH.—The field of this work may be divided into three classes—(1) the encouragement of independent research workers, (2) the organization of research by industries, and (3) the organization of national resarch. Regarding the encouragement of research workers in colleges and universities, it is estimated that $150,000 will be usefully expended on this service during the next academic year. The relatively small size of most British firms and the shortage of well-trained research workers and even of routine workers in science have made it desirable for the government to encourage coöperation between firms in the industries. This coöperative research is supported by those receiving the benefits, but if further help is needed, an annual "grant in aid" to the association for a period of five years can be made. In addition to the research work carried on by the departments of state, the government is to act as a clearing house for information on the status of various phases of scientific and technical knowledge that may be accumulated as the result of work by other investigators.—London *Electrician*, March, 7, 1919.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

LAMME AND WEAVER HONORED BY THE A. I. E. E.

Edison Medal Presented to Benjamin G. Lamme—Unveiling of W. D. Weaver Memorial Tablet—Remarks of President-Elect Calvert Townley

The American Institute of Electrical Engineers held its annual business meeting on Friday evening of last week at the Engineering Societies Building, New York City. W. B. Jackson, vice-president of the Institute, who presided, said that the year just ended had been full of accomplishment but that the new one gave promise even greater. The report of the board of directors was distributed in the form of a pamphlet.

The new officers, as announced in the report of the tellers, are:

President—Calvert Townley, New York.

Vice-presidents—Charles E. Skinner, Pittsburgh; John B. Fisken, Spokane; N. A. Carle, Newark, N. J.; L. R. Jorgensen, San Francisco; Wills Maclachlan, Toronto; A. M. Schoen, Atlanta.

Managers—L. E. Imlay, Niagara Falls; L. F. Morehouse, New York; F. F. Fowle, Chicago.

Treasurer—George A. Hamilton, Elizabeth, N. J. (reëlected).

The above, together with the following hold-over officers, will constitute the board of directors for the next administrative year: C. A. Adams, Cambridge, Mass.; W. A. Del Mar, New York; G. Faccioli, Pittsfield, Mass.; W. A. Hall, Lynn, Mass.; E. H. Martindale, Cleveland; F. D. Newbury, Pittsburgh; E. W. Rice, Jr., Schenectady, N. Y.; Charles Robbins, Pittsburgh; Charles F. Ruffner, St. Louis; W. I. Slichter, New York; Wilfred Sykes, Pittsburgh. Ten states and Canada are represented in the above list. The number of valid ballots cast for president was 2269.

At the meeting of the board of directors held on the same date F. L. Hutchinson was reëlected secretary of the Institute for the coming administrative year.

Mr. Townley in a brief address said he considered it no time to make a speech, but that to decline to say a few words would be discourteous to the association which had honored him by making him president. The question of honor, however, was secondary, he said; an engineer was worthy of the name only in so far as he went ahead and did things. In the same way the Institute must be constantly on the watch to find new means for service if it is to be worthy of the name of a national institution.

The Weaver memorial tablet, erected in acknowledgment of the services of William D. Weaver to the Institute, was unveiled following an appreciation of Mr. Weaver's work by Dr. A. E. Kennelly. To Mr. Weaver, said Dr. Kennelly, was due much of the credit for the establishment of the great technical library now quartered in the Engineering Societies Building, and it was fitting that his portrait should form part of that library, for, declared Dr. Kennelly, "Where a man's heart is, there should his head be also."

Mr. Weaver's talent for ferreting out and appraising electrotechnical literature amounted almost to genius, said the speaker. Whereas most men able to judge one type of technical literature have no ability for appraising other types, Mr. Weaver was skilled in appreciating all. His work as editor of the ELECTRICAL

WEAVER MEMORIAL TABLET

WORLD, said Dr. Kennelly, established a high standard for electrotechnical literature. Mr. Weaver also had a remarkable talent for judging men. While most men are self-seekers, the speaker declared, Mr. Weaver is preëminently a seeker of others, and there are many men now leaders in the engineering world who owe their first success to him.

During the meeting the formal presentation of the Edison medal was made to Benjamin G. Lamme "for invention and development of electrical machinery."

The medal is awarded annually, it was explained by Dr. Carl Hering, by the Edison medal committee "for meritorious achievements in electrical science, electrical engineering or the electric arts." The medal was founded in 1904 by associates of Thomas A. Edison, whose object was to commemorate the period in the rise of electrical engineering of which Edison is typical. The award is in the hands of the Institute, and the practice is to confer it yearly.

In discussing Mr. Lamme's work B. A. Behrend said that the choice of the medal committee was especially fitting since Mr. Lamme had just completed thirty years of service in the electrical field. His work served as a bridge connecting the days when the science of electricity was in its incipiency with the present, in which it has become firmly established. Mr. Lamme's versatile personality has impressed itself on the engineering profession and is part and parcel of its development. The untiring labors of Lamme were typical of the science which he helped to build up.

In many-sidedness of intellect as well as in name, and even in personal appearance, Mr. Lamme was likened to his predecessor in the electrical field, Benjamin Franklin.

In his address following the presentation of the medal, Mr. Lamme said it was difficult to express his appreciation in words. He took the award, coming as it did at this time, as acknowledging a change in the engineering profession which has been coincident with his own work. Thirty years ago, he said, there was the bitterest enmity between engineers of different organizations. Men in rival concerns were *ipso facto* personal enemies. This feeling of hostility has now given way to one of coöperation, and one's best friends are sometimes found in a rival organization. This change was brought about, said Mr. Lamme, by the work of such organizations as the American Institute of Electrical Engineers, which by fostering the get-together spirit among members of the profession has revolutionized engineering ethics.

When he went to work for the Westinghouse concern in 1889 Mr. Lamme said that the present methods of designing electrical machinery were unknown. It was just beginning to enter men's heads that electrical, like other types of machinery, could be calculated. Most of his work has been connected with the development of methods of design. He was called upon by the Westinghouse firm to undertake the calculation of a motor in 1890, and he has been designing motors and other machinery ever since.

He thought there was little in his work to appeal to the general public. His life differed from that of many of those who had received the medal in past years in that, whereas they were in many cases free lances, he was a member of an organization which developed along no one line but undertook whatever came along. The inventor is at an advantage compared with the engineer in that he can turn his hand to whatever he takes a fancy, and his work is consequently of a spectacular nature. The engineer, on the other hand, when he has undertaken a task must see it through to its completion. His work is consequently less appreciated than that of the inventor, since it is largely made up of necessary routine.

The achievements which Mr. Lamme considered his greatest were, he said, the development of the rotary converter and that of the single-phase system for railway motors. Difficulty after difficulty presented itself, and at times he felt his efforts were of no use. At one time he stood out almost alone in favoring the use of alternating current. The development of the single-reduction gear motor for railway work is another accomplishment in which he takes pride.

Mr. Lamme declared that the problems which the engineer had to solve in the past are insignificant compared with those which will confront him in the future. From the standpoint of achievement the past looms large, but the accomplishments of the present and future will seem even greater when viewed in proper perspective.

ANNUAL MEETING OF THE SOUTHWESTERN ASSOCIATION

Fifteenth Annual Convention at Galveston Covers Utility and Fuel Problems—Burr Martin of Dallas Elected President

A program which covered a number of subjects and interesting discussions characterized the "Victory convention," the fifteenth annual convention of the Southwestern Electrical and Gas Association, at the Hotel Galvez, Galveston, Tex., on May 12 to 14. Problems of the various classes of utilities received careful consideration in both general and section meetings.

A welcome to the delegates was extended by Mayor Kempner, who said that the city administration has been criticised for permitting an increase in light and power and street railway rates. "The increase was permitted," said Mr. Kempner, "because we were shown that the demands of labor for increased wages were justifiable on account of the increased cost of living expenses and an increase in the charge was needed to meet this additional cost of operation. We are convinced that we did the right thing, though we may suffer for it by going down in defeat at the polls."

Acting President Burr Martin said in the annual address of the president that the increased cost of labor and materials necessitated increases in the charges for service. The increase in charges should not be merely sufficient to cover the losses in revenue. Public utilities have the right to expect to prosper. Mr. Martin said that the companies should work to educate the public to realize that the increases have to be made if the efficiency of the utilities is to be maintained.

Mr. Martin also spoke of the difficult problem of fuel. During the war there was an increase in the cost and scarcity of fuel. New oil fields in Texas and Louisiana had provided for this need for many years in the past. The number of seagoing vessels, however, is increasing, and as these use oil for fuel there will be an increased drain on the supply. Natural-gas consumption is practically limited to domestic uses. Mr. Martin spoke of the lignite resources of Texas, which can be converted into good fuel, while in the process by-products of some value can be obtained.

Public confidence, said Mr. Martin, is the greatest asset public utilities can have. Without it managers fight a losing fight. They may go against public opinion a while, but they will suffer sooner or later. Before changes are made, or a new system is installed, Mr. Martin said that the utilities must take the viewpoint of the public and strengthen public opinion in their favor. He thinks that the attitude of managers of

utilities has been too impersonal. The public has seen managers come and go, receiverships and bankruptcies, but yet the public utilities remain.

A. Hardgrave of Marshall, third vice-president, said that utilities have not taken the time to advise the people that their business is different from the ordinary business where the capital invested is turned over two or three times a year. "We must turn the spotlight on our own business," he said, "and we will not overcome some of our problems until we do."

Secretary H. S. Cooper of Dallas urged that efforts be made to increase the membership.

J. C. McKay, president Texas Lignite Operators' Association, made an address in which he said that readjustment to normal conditions has not been automatic as the orders providing for temporary rate increases by public utilities had indicated could be expected. The prices of fuel, materials and labor remain at an advanced rate.

Milton H. Wagner, United States Bureau of Standards, read a paper on "Standardization, Its Practical Application in the Public Utility Business," advocating the general adoption of the National Electrical Safety Code.

At the first light and power session S. R. Bertron, Jr., Houston Lighting & Power Company, presided. Discussing "The General Trend of Electric Light and Power Business in Texas," Mr. Bertron said that many valuable lessons had been learned by electrical and gas men during the war, and that the trouble with operators in the past was that they have not confided in the public and told enough facts regarding their condition. Other papers presented at this meeting were "The Problem of Extensions of Lines with the Medium and Small-Sized Light and Power Plant," by B. F. Cherry, Weatherford Water, Light & Ice Company, and "Power Supply to Oil Fields," by F. N. Lawton, Wichita Falls. Two questions from the round-table questionnaire were also discussed with much interest; "Is there any standard rule for the amount of deposit to be asked from a new customer, both light and power?" and "Do any of the preservative treatments of timber injure its tensile strength or do any of them tend to make a soft or brittle wood harder or tougher?"

On Wednesday three separate sections of the association were held. At the light and power session a paper was read by J. E. Meadors, American Public Service Company, on "The Effect of the Demand Rate on the Construction and Operation of the Power Plant." A number of questions from the questionnaire were discussed. H. O. Clarke, Houston, presided at this session. A. Hardgrave of Dallas was elected chairman of the power and light section for the ensuing year.

At the concluding session on May 14, E. P. Schoch, University of Texas, made an address on "Some Possibilities of Texas Lignite from the Chemical Standpoint." He said in part:

> There are twenty-nine billion tons of lignite in Texas, which is one-third of the amount in the entire nation. The largest supplies in the nation are in North and South Dakota and Montana.
>
> Approximately 15 gal. (56 l.) of fuel oil can be obtained from every ton of lignite, which will make the substance a valuable source of supply if it can be obtained on an economical scale. Another point of view to take in this matter is that the mines of lignite are so located that it will be necessary in most cases to haul it only about 100 miles to the place of consumption, while it usually requires a 400-mile haul to get fuel oil.
>
> Even in the face of the present oil prices I think it would be wise and timely to utilize lignite as a source of supply of oil. There are valuable by-products whose utilization in the process of retorting has been solved.
>
> A capital of $250,000 will be necessary to finance a trial plant to attempt the conversion of lignite. The United States government has promised $100,000 for this purpose. The University of Texas has set aside $20,000 for this plant, and approximately $50,000 is expected to be contributed by the lignite miners. I think this organization should be sufficiently interested in the project to appoint a committee to confer with the Lignite Association and others interested for the purpose of discussing whether this organization shall contribute.

Three prizes were awarded for the best-written answers to the question "What is the most urgent present need of the public utilities in Texas and how can it be best and most quickly fulfilled?" G. H. Cushman of San Antonio was adjudged to have written the best answer, W. B. Tuttle of San Antonio the second best answer, and J. K. Cheseboro of Galveston the third best answer. Mr. Cushman's answer was, in effect, a public service commission which would give stable rulings on rates and remove the question from home politics. Mr. Tuttle's answer was, in substance, a candid, fair presentation of the facts concerning the capital, operation and net revenue of the public utilities. Mr. Cheseboro spoke of the action of officials of Texas cities in regulating wiring.

Following are the officers for the new year: President, Burr Martin, Dallas; first vice-president, A. Hardgrave, Dallas; second vice-president, C. E. Calder, Dallas; third vice-president, Alba H. Warren, El Paso; secretary, H. S. Cooper; and treasurer, P. B. Walker, Dallas.

WESTERN SOCIETY MAY ENLARGE PRESENT SCOPE

Appoints Committee to Investigate the Possibilities of Becoming a Larger Body and of Being More Directly Useful to Members

The Western Society of Engineers, Chicago, in consideration of the problems now before the technical societies throughout the country, both national and local, has thought it a proper time to consider steps for enlarged activities. After informal conferences at which these matters were discussed, the board of directors has authorized the appointment of a committee to recommend plans for the enlargement of the society. This committee consists of E. T. Howson, chairman; F. K. Copeland, R. W. Hunt, C. F. W. Felt, W. A. Rogers and F. F. Fowle.

This committee has begun to study the situation thoroughly and develop plans for the society so as to enable it to render a larger service than at any time in the past. The society was organized in 1869 as the Civil Engineers' Club of the Northwest. In 1881 the name was changed to the Western Society of Engineers. Its members are drawn from all parts of the country, the greater portion of them living in the immediate vicinity of Chicago, and because of its location, its extensive library, lecture room and facilities it is the center of engineering society activities in Chicago. The society, being fifty years old, feels that it could well consider such changes in its constitution as will enable it more clearly to meet the present situation and fill in a larger measure than ever before the needs of Chicago and vicinity.

Public Policy on the Pacific Coast

Report of Pacific Coast Section of the National Electric Light Association Directs Attention to Interconnection, Water-Power Wastes, Labor Rate and Other Issues—"Possibilities Are Boundless"

A remarkably helpful presentation of present conditions, read by John A. Britton, Pacific Gas & Electric Company, before the Pacific Coast Section of the National Electric Light Association at Coronado, Cal., on May 2, contains the views and conclusions of the public policy committee of the section on many problems confronting the industry.

IN THE helpfulness of patriotism during the war no industry more signally distinguished itself, said the report, than did the electrical industry. Without its help and the coöperation of every generating and distributing company the marvels accomplished by all the arms of the government would never have been realized.

On the Pacific Coast new impetus was given to shipbuilding, manufacture of aëroplane motors, and in the intensity of agricultural production. The extent to which electricity entered into the success of these war measures astounded the rest of the United States. Many dormant industries were awakened. California found itself possessed of minerals needed in the manufacture of munitions that had heretofore lain dormant, and not only to the nation but to the Pacific Coast States was added a wealth, not alone of money, but of knowledge.

The first main section of the report was devoted to interconnection. The committee commended the California Railroad Commission and the utilities for the particularly active and resourceful endeavors which they made to bring about the most economical utilization of the generating plants of all of the public utilities of the state, not only hydroelectric but steam as well. The companies acted under direction of the Railroad Commission as a unit. The report adds:

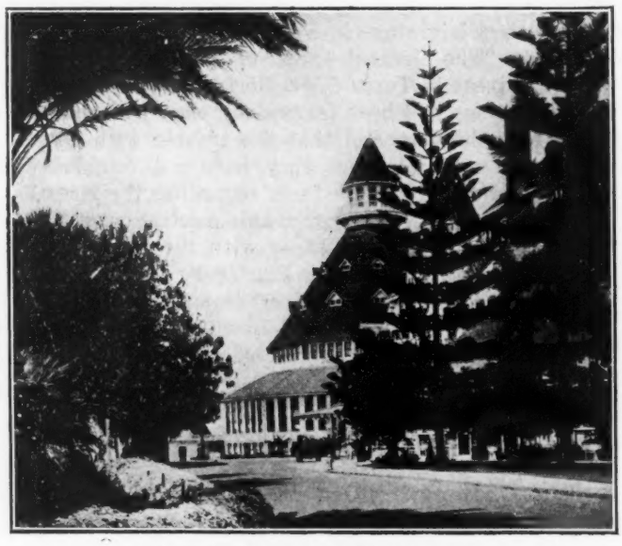
> The help of the regulatory bodies in all the public land states is needed to impress Congress at its next session with the necessity for immediate action in unlocking the doors so long closed to water-power development.
>
> It has been estimated that the net results of interconnection existing and planned will conserve power amounting to over 100,000,000 kw.-hr. per annum.
>
> The diversity in the northern group was not so great as in the southern group. In the northern part of the state each of the companies operated at 60 cycles, and there was no particular difficulty experienced in operating the entire network as a unit. This was not true of the situation in southern California.
>
> The emergency of the war brought about a tie-in with the California-Oregon Power Company, which practically put in service the longest transmission in the world. It is interesting to note in this connection that there remain but four small gaps to complete a continuous tie-in over 2000 miles in length, stretching from Harlowtown, Mont., through the Pacific Coast States and down to the border of Mexico. Thus is very nearly realized the dream of electrical engineers of the Pacific Coast that some day a busbar from Oregon to Mexico might be constructed from which would be fed each of the systems involved. The only limitation on such a project to-day lies in the question of the limited economical capacity voltage at which they may be operated.

Intensity of production in agriculture in the Pacific Coast States was discussed. The war demonstrated that more production is needed.

"Under the intensive electrification of lands it is easily demonstrable," the report declares, "that the Pacific Coast States alone, if they possessed the intensive cultivation of foreign countries, particularly that of southern Italy, could produce foodstuffs sufficient to feed the entire United States."

INDUSTRIAL UNREST

In speaking of unrest in industry the committee says that a vague feeling of industrial unrest confronts the country at this time, very largely augmented by fear. "Is not one of the first steps necessary to improve this situation for us all to pick up our courage and resume active expansion?" asked the committee. "Should our development work be held back because the cost of money, materials and labor is more now than under pre-war conditions?"



CORONADO HOTEL, CORONADO, CAL.

The committee discussed the question of whether the time has not come when the workers in our industries must have opportunity to participate in the increment of their own labor. "Participation is said to be the antidote to anarchy," said the committee.

To provide opportunity to employees to become stockholders has been found to be effective.

The principle of reward for efficiency in operation was also urged. "The utility," the report declares, "which through initiative, research or design, or through wise, skillful and diligent management, has reached a point of such efficiency that it is enabled to improve its service to its consumers, to operate at a lower cost and more advantageously to finance its requirements should not be crowded into a position where it will be stripped of all the benefits of its performance, but rather should receive a recognition which would tend to put a premium on careful, economical and efficient operation."

During the past year the California Commission has made numerous adjustments in rates for service, in the majority of cases by the addition of surcharges. This form of added rate was adopted to compensate for specified increased costs, in order that adjustments might be made from time to time if costs were reduced or increased, and in order that the whole amount of the increase might be readily eliminated when the cost of operation returned to the normal pre-war basis.

LOOKING TO THE FUTURE

Looking ahead to future conditions, the report calls attention to the fact that since the help given by the commission to utilities conditions of operation have suffered little or no change, wages remain at war-time prices, taxes have increased, the cost of money has increased, and material and supplies of the character used by utilities have not changed very greatly. On this point the committee adds:

The hope is ventured that the commission may in readjustments of rates eliminate to a large extent the surcharge, which bears the impress of a war-time measure and therefore now that war has ceased ought to be eliminated, and make such adjustments of schedules as will compensate the public utilities to the same degree and help to maintain their increased efficiency.

It is the conclusion of the committee that to develop a feeling of security among investors not only must there be action by the commissions but as well the education of the masses. The report continues:

The public utilities are not sufficiently alive to the necessity for this education. They do not get to the vitals of their interests when they neglect by the means within their power the proper education of the people. While there has been a change for the better in respect to this in the past few years, the field is still comparatively untouched.

Advertising to a degree accomplishes it, but better still would be the personal contact by heads of public utilities with the public in explanation of their difficulties and problems; also the education of the employees of the utilities in such a way that they would be able to discuss with the consumers properly the trials and difficulties as well as the aims and ambitions of the utilities.

The committee believes that there should also be engendered among employees the feeling that the corporation is alive to their personal interests.

As a matter of policy to be adopted by all members the committee recommends reëmployment of all employees who were inducted into the service of the United States either by draft or by voluntary enlistment.

Possibilities electrically on the Pacific Coast are boundless, not only in the production of electricity but in its extended use. There is no part of the world where its use is more general or more diversified. The committee continues:

The average rate per kilowatt-hour at which energy is sold upon the Pacific Coast is less than that of any other section of the United States. This is partly due to hydroelectric developments and also to the greater diversity of use, and as soon as there is a relaxation by the government of its drastic rules governing possession of public lands, so soon will arrive a lower rate for the benefit of the communities which we serve.

The future of our industry on the Pacific Coast was never brighter. With the intensified education predominant here in the utilization of our commodity, and with a certainty of a proper return upon capital being given and with the lessons learned at this convention respecting contact with the public and the consumer as well, it is certain that the demand for electricity will continue and increase. Not the least of this demand will arise from the installation of house appliances, particularly the electric range. In reconstruction, labor must be fully considered.

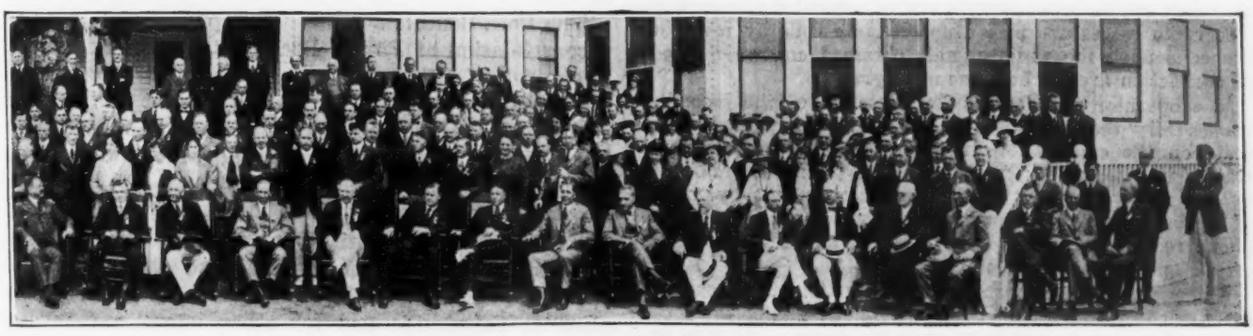
The committee strongly recommends to the companies a more careful consideration of the relation toward legislation. It does not mean by this that corporations should again enter politics, but it does mean that the corporation with millions of invested capital should see to it that in a fair and just way it shall be protected by such educational knowledge of the masses that representatives in legislative bodies will have due cognizance of its rights.

MUNICIPAL OWNERSHIP NOT DEAD

Municipal ownership is still rampant, the committee declares, under misguided and misinformed conditions. Much of the tendency that engenders municipal ownership can be arrested, in the judgment of the committee, by a policy of publicity that should be the same throughout the territory of the organization. The conclusion of the committee is:

Municipal ownership arises primarily from some misguided policy instituted by some public utility, in which an error of judgment on the part of the utility provokes the righteous indignation of right-thinking men, and the only relief apparent is in service to itself by the municipality; and once this seed is planted there are plenty of people who, without due knowledge, become rabid advocates of public ownership.

The underlying motives creating municipal ownership are twofold—first, dissatisfaction with the utilities' action, whether applied to the municipality or the public, and, second, the misleading statements of low costs of operation and large profits, which are contrasted with prices charged in other sections by privately owned utilities. Both of these fallacious arguments may be successfully met if the public utilities will move with one accord on the first motive, and to destroy the second motive secure legislation which will provide at least for some means to cause the municipally operated utility to keep its accounts by the same methods as those by which privately owned utilities are required to keep theirs. On the same basis of determined costs no privately owned utility need fear comparison with the publicly owned.



DELEGATES TO THE CONVENTION OF THE PACIFIC COAST SECTION OF THE N. E. L. A.

RADIO EQUIPMENT ON THE NAVAL SEAPLANES

Details of the Apparatus on the Transatlantic Seaplanes Are Made Public by the Navy Department

Acting Secretary Roosevelt of the Navy Department has made public some details of the radio equipment on the NC type of seaplanes undertaking the transatlantic sea flight. His statement says in part:

The radio on the NC seaplanes involves two transmitters. One is a 0.5-kw. spark transmitter, the main element of which is a stream-line generator and accessory apparatus, which is driven by an air propeller and is mounted on the deck of the boat aft. This set weighs only 45 lb. (20 kg.), but is used for the regular telegraph communication between the seaplanes and stations up to a distance of 250 nautical miles (463 km.). Since this set is driven by a propeller, it can be used only while seaplanes are in flight. The antenna used for this set is a single trailing wire leading from the tail of the boat for a distance of 250 ft. (76 m.) down and to the rear. A stream-line lead weight holds the lower end of this wire down.

With this transmitter it is possible for the commanding officer to send messages from time to time regarding the progress of the flight, to be retransmitted by the nearest shore station to the Navy Department. Also communication can be held with destroyers or other craft and radio compass signals or other information requested.

The other transmitter is a combined telephone and telegraph transmitter, and operates on a small 12-volt storage battery. It is used on an antenna consisting of wires permanently stretched on the skid fins on the upper planes so that it may be used while the seaplane is in flight or on the water.

It is this set which is used for telephoning between the planes, arrangement being made so that either the radio operators or the commanding officers themselves may communicate directly by telephone while the planes are in flight. Such interplane telephoning may be carried on up to a distance of 20 miles (32 km.). While on the water this set may be used for telegraphing or telephoning a distance of about 30 miles (48 km.).

A special feature of the telephone sets is the anti-noise microphone, which is so constructed that the engine noises are not heard. This is accomplished by having the back of the microphone open. The exterior sound waves strike the back as hard as the face of the diaphragm, and therefore the effect is neutral. The voice waves strike only the face of the diaphragm, and even though the operator cannot hear his own voice, the radio sets receive enough effect to modulate the transmitted wave.

This single item has been the deciding factor in success or failure in long-distance transmission by telephone by airplanes. It is easy enough for short distances to get communication with an ordinary microphone, but for long ranges it is impossible without the anti-noise transmitter.

One of the most important of the radio installations on these seaplanes is the radio compass. This consists of a set of revolving coils mounted in the tail of the machine, on which are mounted many turns of enameled copper wire. The radio waves are picked up on these coils by revolving the coils until the radio signals obtained on two methods of connection are of the same strength.

The operator then knows the direction of the incoming waves. By then reading the position of a pointer on a scale on the coils the bearing of the transmitting radio station is determined. This bearing is then communicated by the radio operator to the navigating officer by means of the intercommunicating telephone, which consists of telephone receivers built into the helmets, and the same type of microphone used by the operator.

Using the same intercommunicating telephone system, the navigator can telephone to the pilots, giving them the proper direction in which to steer the plane. He may inquire of the engine room regarding the condition of the engines, or he may hold radio-telephone conversation with the navigating officer on one of the other planes.

In other words, the intercommunicating telephone makes possible constant communication between all members of the crews in spite of the terrific noise caused by the engine and the wind rush and in spite of the fact that they are in separate parts of the seaplane. In addition to this the radio telephone makes it possible for the commanding officer and navigators to talk directly with each other, although their seaplanes may be flying at a distance of 20 miles apart.

The radio compass signals may be received from a destroyer at a distance of 75 miles (120 km.) or from large land stations at a distance of 600 miles (965 km.).

The regular receiving apparatus on the seaplanes will permit of reception from land stations of high power at distances of several thousand miles, thereby permitting the seaplanes to copy weather reports or orders directly from the Navy Department at Washington.

The most striking fact regarding this radio equipment is that, completely installed, it weighs only 200 lb. (90 kg.).

CHANGE OF CONTROL IN IOWA PROPERTIES

David G. Fisher & Company of Davenport Purchase Majority Interest in Iowa Southern Utilities Company—Improvements and Expansion Planned

David G. Fisher & Company of Davenport, public utility engineers, have purchased control of the Iowa Southern Utilities Company, the stock and bonds of which total $2,500,000. This company furnishes electric power to thirty Iowa towns, 33 miles of interurban lines, principally coal carriers, the Centerville (Iowa) street-railway, gas, heating and electric light plants and 240 miles (386 km.) of high-tension transmission lines.

The Fisher interests, formerly owning a minority share of the stock, have purchased the holdings of Frank S. Payne and D. C. Bradley. Mr. Payne, who has been general manager, will remain with the company as director and general counsel. It is understood that the transaction involved a sum in the neighborhood of $450,000.

The formal transfer of control will be made May 15. J. C. Johnson, now secretary and treasurer of the Fisher company, will be the new general manager of the properties. Before becoming affiliated with the Fisher company he was superintendent of the Fisk Street station in Chicago. Ernst Jacobson, vice-president of the Fisher company, will have a prominent part in the active administration of the company, President David G. Fisher announced.

The Fisher company was organized in Davenport in 1909 and soon after that time began to purchase and operate public utility plants. The majority of the company's holdings are in Iowa. The gross business of the company last year was in the neighborhood of $450,000.

The Iowa Southern Utilities Company was formed by a consolidation of Payne, Bradley and Fisher interests in the fall of 1916. The companies represented in the consolidation were the Centerville Light & Traction Company, Centerville Electric Company, Centerville Gas Company, Leon Electric Company, Mount Ayr Light & Power Company, Lennox Electric Company, Clearfield Electric Company and Blockton Light & Power Company.

Besides supplying thirty towns the company furnishes light and power for thirty coal and gypsum mines. Plans are already laid for the rebuilding of the power plant at Centerville and for other improvements and expansion.

DELRAY CENTRAL STATION SOON TO BE REVAMPED

Plans of Detroit Company for Bringing Total Generator Rating of One of Its Large Plants Up to 130,000 Hp.

Plans have been perfected by the Detroit (Mich.) Edison Company for the installation of a new 30,000-kw. unit in plant No. 2 at Delray. To receive it an extension will be made to the turbine room and a new switch house will be built. Work on the foundations has started already, and some time next winter it is thought that the unit will be ready for service. At present plant No. 1 at Delray can carry a maximum load of 44,000 kw. and in plant No. 2 the ultimate capacity is 62,000 kw., made up from four machines, three having a nominal rating of 14,000 kw. each, and the fourth one of 15,000 kw. By the addition of the new unit and with more economical loading of the older machine the Delray station will carry handily 130,000 kw.

It so happens that the Delray station has an exceptionally adequate installation of boilers, or will have when the new unit is installed, owing to its low water rate, so that instead of installing a sufficient number of boilers to carry the new unit it will be necessary to add only two 1300-hp. Stirling boilers of the same type as the 2365-hp. boilers that have long made this plant a leader in steam generation. This is explained by the fact that the new unit will carry 20,000 kw. on the same quantity of steam required by a 14,000-kw. machine. Then by adding sufficient boiler capacity to carry 10,000 kw., the load considered normal for one of the large boilers or the two new boilers, ample provision has been made for the installation of the 30,000-kw. unit.

Eventually it is the plan to remove two of the older machines, one 14,000-kw. and one 15,000-kw., to make room for another 30,000-kw. unit, and finally to substitute a third large unit for the two oldest machines remaining.

Delray revamped will be a refinement of the Detroit Company's Connors Creek station practice. The new General Electric unit, rated at 30,000 kw., will generate three-phase, 60-cycle, 12,200-volt energy, the steam conditions being 200 lb. pressure and 200 deg. of superheat and the speed 1800 r.p.m. The generator leads will be tied solidly to the low-tension terminals of a three-phase compensator-type 12,200/24,000-volt transformer. This will feed through single-conductor cables carried underground to the machine switches in the switch house which is being built at the north end of the Delray site. There will be no main switching done in the power house proper.

On the steam end the condenser auxiliaries will be driven by direct-current motors to insure a wide range of speed variation and convenience of operation. To effect a heat balance the plant will be provided with an auxiliary turbine exhausting into a heater condenser. To supply the motors the generator will be a direct-current machine. Ruggedness and simplicity of control are the reasons assigned for the choice of direct-current apparatus.

As the energy required by the auxiliaries is not at all times proportional to the load on the main generator, there will be times when the auxiliary power demands, if supplied entirely by the auxiliary turbine, would involve an excess of exhaust steam—more than enough to heat the condensate from the main unit. At other periods the conditions may be reversed. To meet this situation a synchronous motor-generator set will be installed. When the load on the main unit is light and the auxiliary apparatus requires more energy than the auxiliary turbine will supply, incidentally to heating the feed water, the deficiency will be made up from the main bus through the motor-generator set, and this source will be drawn on should the auxiliary turbine be out of commission. At times of heavy load, when in order to heat the feed water it will be necessary to generate more energy than the auxiliaries require, the surplus will be transformed to the main bus through this same motor-generator. This arrangement is unique and, because of its flexibility, should prove an advance over former practice.

There will be a rearrangement of steam piping in the station, and as at Connors Creek direct-current motors will drive the blower equipment. The ash aisles will be separated from the blower rooms and consequently be removed from the main ventilating circuit. More complete details will be available when the new unit is in operation.

ENGINEERS DISCUSS THEIR RELATIONS TO CIVIC LIFE

American Association of Engineers' Convention Crystallizes Thinking on Problems That Affect the Engineers as Individuals

Salary schedules, employment problems and opportunities, proper compensation and society interrelationships were the main features discussed at the annual convention of the American Association of Engineers, held May 12 and 13 in Chicago. Ninety delegates from thirteen of the association's chapters and three clubs were present, although the attendance was 186 at the largest session.

Changes were made in the constitution to establish a national practice committee, which is authorized to report on questions of ethical policy and conduct, and a grade of "candidate junior" in the various grades of membership was established. According to other changes in the constitution, chapters are to recommend grading of candidates, junior members may now vote but not hold office, the last past-president is a director, and the board is authorized to make mutual agreements with other societies.

The warmest discussion of the convention was over the proposal to fix the entrance fees at $5 or $10. By the present by-laws, which were retained, entrance fees automatically are increased $2 for each 500 members above 1000, the count to be made in December each year for the year. Apprehension that the fees would be so high as to keep out younger members gave way to the idea of the increased service that could be rendered by larger income.

Addresses and papers were presented by Fraser S. Keith, secretary of the Engineering Institute of Canada; H. G. D. Nutting on "Ways and Means of Obtaining Proper Compensation," F. H. Myers on employment activity, and others.

The election of officers resulted as follows: President, F. H. Newell; vice-presidents, W. W. DeBerard and F. A. Evans; new directors, W. W. K. Sparrow, P. E. Harroun, R. Burnham, F. D. Richards, A. A. Matthews and G. F. Collins. The next annual convention will be held in St. Louis.

MISSISSIPPI SECTION RESUMES ITS MEETINGS

N. E. L. A. Section Starts Activities After Four Years of Quiet Due to the War—H. E. Brandli of Meridian Elected President

Owing to war conditions the Mississippi Section of the National Electric Light Association did not hold a meeting for four years until April 15 to 17, when the members convened at the Great Southern Hotel, Gulfport, Miss.

The meeting was an enthusiastic one and was well attended by representatives of central-station companies throughout the state, as well as by supply men and jobbers in the district. Discussions on all papers were entered into by those in attendance. One of the interesting social features of the program was the boat trip from Biloxi, Miss., around the bay.

Every effort is being made to liven up the spirit of the association, and it is hoped during the year to get every eligible company in Mississippi to join.

In the absence of W. T. Stewart, president of the Mississippi Coast Traction Company, Gulfport, Miss., Barney E. Eaton, attorney for the Gulf & Ship Island Railroad, an allied interest, gave the welcoming address.

COMPREHENSIVE PRESIDENTIAL ADDRESS

H. F. Wheeler said in his presidential address that the inactivity of the association during the last four years was due to various causes. While the war lasted there was little time for anything except duties to the government. Another cause, Mr. Wheeler felt, had been the connection with the National Electric Light Association.

"I should qualify this statement," he continued, "by saying that since the association of the Mississippi Electric Association with the National Electric Light Association the members have seemed to lose all interest. When a meeting of Class A members was called it was usually attended by three or sometimes four representatives, and usually the same ones attended each meeting. There has always been more or less discussion at each meeting as to whether or not it would be better to withdraw from the national association and start out on our own independent way again. I was formerly one of those who thought possibly it might be, but after seeing the activities of our parent organization during the war, as evidenced by the National Committee on Gas and Electric Service, the National Committee on Public Utility Conditions and the other work done by the national association, I feel that we should be doing wrong to withdraw. What I now feel is that each member should here and now make a resolve to give the Mississippi Section and the National Electric Light Association its whole-hearted cooperation, even to the sacrificing of some little time and money. The war is now over, and the time is opportune for making a new start."

Mr. Wheeler then took up the rate situation, saying that during the last year most of the companies had to ask for increased revenue. In many instances this was granted cheerfully by the communities, but in a few cases the public, influenced by a selfish motive, took advantage of the utilities' unfortunate condition and refused relief.

"In a number of instances," he added, "I feel that we have been cowardly and have been afraid to lay our cards on the table and ask for higher rates. Many companies have been forced into bankruptcy, and the public is now beginning to realize that when a utility does ask for higher rates there is possibly some necessity for it, and after this idea becomes more general it is my opinion that the tide will turn and that at least an impartial hearing will be granted."

After referring to the great growth of the central-station industry, Mr. Wheeler said that there is of course no question as to the future of the central-station plant. There are, however, three points under present conditions which must be given particular attention.

"First," he said, "every property must get and maintain rates which will permit a fair living profit. Too much emphasis cannot be laid on this point, for rates that are too low not only endanger the company making them but all of the plants within a considerable radius. I need not dwell on how when one of your rates is in question the board of inquiry immediately asks all of your neighbors their rates. It then picks out the lowest, not the average, rate and forces you to meet it.

"The second point lies in the fact that the central station is a large and continuous consumer of new capital. If this is not forthcoming, extensions cannot be made to meet the city's growth and a company stagnates, prospective customers become dissatisfied because service cannot be obtained, and public sentiment is eventually turned against the company. This point is also dependent upon the first, for new capital cannot be secured if the income is not sufficient to warrant investment.

"The third point is the tendency toward municipal ownership. I do not propose here to make arguments for or against it, but only wish to impress this fact, taken from statistics from the Bureau of Commerce report. In the five years between 1912 and 1917 there was a net increase of 565 commercial plants and 765 municipal plants. While it is true that more than this number of commercial plants were established, there have been many combinations which have brought down the actual number of new plants. Nevertheless, after making allowances for this fact, the figures are alarming."

In concluding, Mr. Wheeler spoke of the effect of the general level of prices on the industry.

SUBJECTS DEALT WITH AND NEW OFFICERS

Among the subjects discussed were: "Public Utility Conditions in Mississippi," by L. O. Gordon, Jackson Light & Traction Company; "Public Relations," Frank J. Duffy, Southern Railway & Light Company, Natchez; "What Do Public Utilities of Mississippi Most Need?" discussion opened by R. B. Claggett, Delta Light & Traction Company, Greenville; "Rates," H. E. Brandli, Meridian Light & Railway Company; "Coal Situation," Monro B. Lanier, president Monro-Warrior Coal & Coke Company; "Possibilities of Crude Oil as Boiler Fuel," Charles M. Rogers, president Rogers-Higgins Manufacturing Company; "Care and Operation of Boiler Room," E. J. Lenz, Delta Light & Traction Company; "Securing New Business," E. B. Booth, Vicksburg Light & Traction Company.

H. E. Brandli, vice-president and general manager of the Meridian Light & Railway Company, was elected president of the Mississippi Section. E. S. Myers, manager of the Vicksburg Light & Traction Company, was elected secretary.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

S. A. E., Summer Meeting.—Plans are being completed for the summer meeting of the Society of Automotive Engineers to be held at Ottawa Beach, Mich., June 23 to 27.

Second Industrial Service Conference Held in Wisconsin.—The second annual industrial conference was conducted under the auspices of the Industrial Commission of Wisconsin in Milwaukee on April 28-30.

Engineers' Club of St. Louis.—This organization is conducting a campaign to assist in raising a fund for the reception and entertainment of the Twelfth Regiment Engineers upon their return to St. Louis, Mo.

A. I. and S. E. E., Annual Convention. — The thirteenth annual convention of the Association of Iron and Steel Electrical Engineers is to be held in the Hotel Statler, St. Louis, Mo., on Sept. 22-26. Exhibits are to be a new feature at the convention.

A. S. M. E., Buffalo Section.—E. S. Collins, engineer of the industrial heating department, General Electric Company, Schenectady, N. Y., recently delivered an illustrated lecture on "Industrial Applications of Electric Furnaces" before this section of the American Society of Mechanical Engineers.

New Electrical Association Formed in Milwaukee.—The Milwaukee Electrical League and the Milwaukee Jovian League have disbanded and a new organization, known as the Electrical Association of Milwaukee, has been formed. The first meeting, at which a new constitution was adopted and temporary officers were elected, was held not long ago. The objects of the new association are to promote social and commercial fellowship among its members, to further the interests of the electrical industry both locally and nationally, and to serve in the civic advancement of the community. It is also the purpose of the association to promote, if possible, the organization of a national body representative of the entire electrical industry and having objects corresponding to those of the local association. The membership is divided into six sections—contractors, dealers, jobbers, manufacturers, public utilities, and sales engineers. The association work will be carried on by a board of directors consisting of a president and six directors, one of which is chosen from each section of the membership. The meetings are to be held monthly. G. G. Post of the Milwaukee Electric Railway & Light Company is secretary of the new association.

Railway Electrification Urged by Ontario Hydroelectric Municipalities.—Three hundred representatives of the Ontario Hydroelectric municipalities held a meeting at Guelph, Ontario, on April 25 and decided to ask the Dominion government to turn over to the Hydroelectric Commission for electrification the branch lines of the Grand Trunk Railway and Canadian government railways. Also the meeting asked for immediate authority for the construction of hydroelectric railways already approved, involving an expenditure of $62,000,000.

Northwest Electric Light and Power Association.—The hydroelectric and technical committee of the Northwest Electric Light & Power Association found it desirable two years ago to hold monthly meetings for considering the National Safety Code. Other technical questions received consideration in a way that was found to be of great mutual advantage. The meetings were, in fact, too helpful to be discontinued and are still being held every month, usually with full attendance. Only topics of general interest are presented. The meetings are very informal, the purpose being to pool experience and information on technical problems for the benefit of all.

Iowa Section, N. E. L. A.—The tentative program for the meeting of the Iowa Section of the National Electric Light Association, to be held in Colfax, Iowa, June 18, 19 and 20, includes these addresses: Howard S. Phelps on "Transmission Lines and Telephone Interference," John E. Brindley on some economic question, F. D. Paine on "Testing Meters in Small Towns," J. B. Hill on "Principles of Rate Making in Small Towns," W. G. Raymond on some economic question, William Chamberlain on "Rate Litigation in Iowa," F. A. Warfield on "Rates as Affected by the Increased Cost of Production and the Attitude of Regulatory Bodies Thereto" and John A. Reed on "Municipal Ownership in Iowa."

American Institute of Electrical Engineers

Lynn Section.—"Submarine Detectors" was the subject of C. E. Eveleth, turbine engineering department, General Electric Company, Schenectady, N. Y., at the May 6 meeting of the section. Mr. Eveleth traced the stepe from early developments to the equipment of the Allied fleets with these devices and also recounted the tactics used on submarine chasers using the detectors.

Schenectady Section. — Two talks were given at the section's May 2 meeting. One, entitled "Pliotron Vaccum Tubes and Their Application to Radio Apparatus," was given by W. C. White, Research Laboratory, General Electric Company, and the other, on "Radio Apparatus for Aircraft and Ground Stations," was presented by E. M. Kinney, general engineering laboratory, General Electric Company.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Depreciation Requirement Repealed.—In a case affecting the Jacksonville Railway & Light Company the Illinois Public Utilities Commission repealed its orders requiring the utility to dispense with any allowance to meet depreciation on the electrical property during the year 1918 where it was shown that abnormal operating conditions during that year so depleted its revenues that they were entirely used in the payment of operating expenses, taxes and fixed charges.

Provision of Additional Facilities.—Although authorizing increased electric rates for the Cairo Electric & Traction Company, the Illinois Public Utilities Commission directed the company to provide additional facilities. The commission says: "The Public Utilities Commission law provides that all public utilities in the state shall furnish service of an adequate character. The respondent has realized for years past that it has not been in a position to furish such service. The record shows that various interests in Cairo have equipped their plants for electric drive at considerable expense. In some cases consumers utilizing the company's services have been forced to install means for securing other power supply. Manufacturing interests which have proposed to locate in Cairo have been compelled to consider seriously the general character of power supply and have found that it has been of such a character as unfavorably to influence them. It appears that the respondent has been extremely dilatory in its failure to remedy these conditions which it has known to exist. The commission believes the time has come when the respondent should immediately initiate a procedure which will offer early and adequate relief. It appears that the respondent has in contemplation the purchase of equipment from the manufacturer which it is estimated will require seven months to deliver and an additional two months to erect. It is obvious that a delay of this character in relieving the situation in Cairo does not constitute an adequate solution of the present situation. There are other means by which the equipment may be secured and while it is possible that this equipment may not fit in so well with the equipment already installed in the station or may not be of the particular type which the respondent feels is best suited for its requirements, yet the time for the consideration of these matters has passed and the situation at present demands immediate action."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Ohio Supreme Court on Rate Schedules.—The Ohio Supreme Court on April 29 affirmed a decision of the lower courts in which the Ohio River Power Company was enjoined from putting into effect a new schedule of rates for private consumers at Steubenville which had been filed with the Public Utilities Commission. A lower rate had been accepted by the predecessor of the company in that city, and all the courts held for the municipality. On the other hand, the court held in favor of the company in a suit brought to enforce a contract for service with the Patterson Foundry & Machine Company. The contract was for two years, renewable for ten years, and the renewal option was exercised. The original contract was signed on June 30, 1911, the day a new law went into effect relating to filing schedules of rates with the commission. In June, 1917, the company refused to furnish energy under the private contract on the ground that the schedule of rates filed with the commission held. The courts sustained this contention.

Large Financing Plans of Baltimore Company.—President Herbert A. Wagner of the Consolidated Gas, Electric Light & Power Company of Baltimore has issued a circular regarding a general mortgage authorized by shareholders. The total amount of bonds that may be outstanding at any time is limited to $100,000,000. A first series issue of $5,000,000 was authorized, $3,500,000 of which is to be pledged to secure in part an issue of $5,000,000 three-and-one-half-year 7 per cent notes, which, together with the remaining $1,500,000 reserve, will provide for the conversion of the three-and-one-half-year 7 per cent notes. The proceeds of these $5,000,000 notes, together with additional cash to be furnished by the company, will provide $6,000,000, which will be used for the acquisition of equipment, buildings, etc., and for extending the capacity of electric power plants, etc. This financing will provide for the company's needs well into 1920. The first $3,500,000 of bonds are to be issued under the new mortgage, which will cover all the property now owned or hereafter acquired and will be a part of the $100,000,000 authorized. They will bear 6 per cent interest and will mature Feb. 1, 1949. The bonds will be redeemable on sixty days' notice during the first five years at 110, during the next five years at 107½, during the next fifteen years at 105, and durin the last five years at the rate of 102.

Electric Trucks in Metropolitan District.—A. Jackson Marshall, secretary Electric Vehicle Section, National Electric Light Association, declares that on Jan. 1, 1919, there were approximately 33,000 automotive street trucks in the New York metropolitan district. Of these, there were 3288 electric trucks. In other words, about 10 per cent of all automotive street truck equipment in New York City was of the electric type. These electric street truck figures do not include several hundred electric industrial trucks and tractors in use.

Power Survey in Mexico.—A newspaper dispatch from the city of Mexico says that applications for renewal of concessions for installation of hydroelectric plants and development of the water-power resources of the country have been received recently by the Department of Commerce and Industry. Original concessions granted Americans and other foreigners by the late President Diaz were canceled by the Carranza government for alleged nonfulfillment of contract. The government is planning to make a complete survey of available sites for hydroelectric plants and to estimate the amount of energy which may be generated.

Business Training for Engineers.—The Commissioner of Education of the Bureau of Education, Department of the Interior, has issued a call on behalf of the conference committee on commercial engineering recently appointed by him for a public conference on business training for engineers and engineering training for students of business. This conference, national in scope and in character fully representative of all interests, will be held at the New Willard Hotel, in Washington, Monday and Tuesday, June 23 and 24. All educational institutions, commercial organizations, manufacturing associations and educational and engineering societies are cordially invited to cooperate and to designate one or more representatives to attend the conference. Prominent engineers, educators and business men will be invited to discuss the following major topics: Business training for the engineer, engineering training for commercial enterprises, significance of the war experience for engineering education, and training of the engineer for overseas engineering projects. Glen Levin Swiggett, specialist in commercial education, chairman of the conference committee on commercial engineering, has written an invitation to commercial organizations, manufacturing associations and educational and engineering societies to send delegates. At the meeting of the conference committee on commercial engineering in Washington on March 31 the Amercian Institute of Electrical Engineers was represented by E. W. Rice, Jr., president General Electric Company, his alternate being Francis C. Pratt, who is assistant to the president of the General Electric Company.

New York Franchise Tax Held Valid.—In a unanimous decision the Appellate Department of the Supreme Court, Third District, on April 8 held that corporations in New York State subject to the franchise tax of 3 per cent, based upon "the entire net income," are not entitled to deduct the amount of tax paid to the federal government on account of excess profits before computing the amount payable to the state. With respect to the state statute, the court said: "This is not an income tax; it is a franchise tax. It is a tax for the privilege of doing business in a corporate form in the State of New York, and the only relation of the federal act to the statute of New York is the basis for the computation of the state tax. The state franchise tax thus assessed bears equally upon every like corporation within New York. It does not constitute a double franchise tax, though the national government makes use of the same foundation in levying an income tax." The original ruling of the State Tax Commission, that no deduction of federal taxes would be allowed in computing the 3 per cent franchise tax, is thus sustained.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Warranty of Plants and Systems.—Where the seller guarantees cooking or lighting "plants or systems . . . against defects in materials and workmanship, and warrants same to be in good working order," and in subsequent provision of contract agrees to furnish lighting or cooking fixtures shown in a catalog at 50 per cent of list price, not expressly warranting such fixtures, the warranty of "plants and systems" does not cover such fixtures, the fixtures being covered by a separate and distinct part of the contract, according to the Supreme Court of Wisconsin (171 N.W. 662).

Damages for Injury by Accident While on Vacation.—In a case where an engineer during his vacation, but while in pay of and subject to employer's call, at the request of its superintendent went to inspect a pumping station, to increase his efficiency as an employee, and was injured in an automobile accident on his journey or his way homeward, his widow is entitled to damages for his death as an "injury by accident in the course of his employment" and while "actually engaged in the furtherance of the business or affairs of the employer," within the provisions of the workem's compensation act, according to the Supreme Court of Pennsylvania (106 A. 85).

H. J. Musgrove, until recently in the Signal Corps of the army, has resumed his former duties of local superintendent of the Central Illinois Public Utilities Company at Marion, Ill.

W. B. Wallis, vice-president of the firm of W. E. Moore & Company, consulting steel engineers, Pittsburgh, Pa., sailed on the Mauretania, May 13, for Europe on an extensive trip undertaken to investigate electric furnace operation in the industrial centers of Europe. Mr. Wallis is a graduate of Pennsylvania State College and has been a member of the firm of W. E. Moore & Company for several years. Previous to that he was engaged in development work for various engineering and public utility companies.

Frank F. Fowle and **James R. Cravath** have formed a consulting engineering partnership under the firm name

F. F. FOWLE

of Fowle & Cravath, with offices at 1201 Monadnock Block, Chicago. Frank F. Fowle, who until recently served as one of the receivers of the Central Union Telephone Company, was formerly a consulting engineer. James R. Cravath is a well-known consulting electrical and illuminating engineer of Chicago. Both are men who have made national reputations in their work and are especially well known in Chicago and the Middle West. The services of the firm will be devoted to investigations, research, design, supervision, management, appraisals and rate cases in the several fields with which the partners have heretofore been identified.

Mr. Fowle was graduated from the Massachusetts Institute of Technology, Boston, in 1899, in the electrical engineering course, and then served nine years with the American Telephone & Telegraph Company in various engineering capacities, finally serving as manager of the Chicago territory of the long-lines system. From 1908 to 1912 Mr. Fowle was engaged in consulting engineering practice, headquarters in Chicago. In 1912 he went to New York and jointly with Dr. A. S. McAllister was in charge of the

Men of the Industry

Changes in Personnel and Position—Biographical Notes

editorial department of the ELECTRICAL WORLD. In 1913 Mr. Fowle became editor-in-chief of the "Standard Handbook for Electrical Engineers" and entered engineering practice again in New York. Early in 1914 he was appointed one of the receivers of the Central Union Telephone Company, serving until recently discharged by the court. Mr. Fowle was elected a manager of the American Institute of Electrical Engineers on May 1. He has also recently been reëlected manager of the Chicago Section, Illuminating Engineering Society, and is a member of the development committee of the Western Society of Engineers.

Mr. Cravath was graduated in 1892 from Grinnell College, Grinnell, Iowa. From 1892 until 1907 he was the electrical editor of the *Street Railway Review* of Chicago. In 1900 he became Western editor at Chicago for the ELECTRICAL WORLD and other McGraw publications, remaining on the editorial staff until 1910, when he began to give his time to consulting engineering and executive work, in which he has been engaged ever since. He was for four years president of the Lawrenceville (Ill.) Light & Water Company and for two years secretary, treasurer and managing director of the People's Water & Light Company of Harrisburg, Ill. For the last five years, since its organization, he has been president and treasurer of the Tri-City Artificial Ice Company of Rock Island, Ill. For two years he had general charge of the Menominee Range Power Company, serving the Iron River mining district of Michigan. In a consulting capacity Mr. Cravath has served many companies and municipalities in connection with street-lighting plans, alterations, contracts, public utility rates and appraisals and power-plant economies. He is perhaps best known through his prominence in the illuminating engineering field. He is one of the authors of "Principles of Interior Illumination" and of "Practical Illumination" and the author of "Street Lighting for Small Towns and Cities." He has held numerous offices in technical societies in the electrical and illuminating field, was first secretary of the Chicago Section of the Illuminating Engineering Society, and is at present chairman of the electrical section of the Western Society of Engineers.

L. M. Helmreich, heretofore assistant engineer to the Public Utilities Commission of Missouri, has been appointed engineer of the newly organized Arkansas Corporation Commission to take charge of the general supervision of the utilities operating in that state. He will establish headquarters at Little Rock. Mr. Helmreich was formerly head of the Ranken Mechanical School of St. Louis. He was graduated from the University of Missouri with the degrees of mechanical engineer and electrical engineer.

Henry C. Meyer, Jr., a well-known consulting engineer, has joined with Bassett Jones and William E. S. Strong in incorporating the firm of Meyer, Strong & Jones, Inc., which succeeds to the engineering practice of Henry C. Meyer, Jr. Messrs. Meyer and Jones have been engaged in consulting work in New York City since 1903 and have been responsible for the mechanical, electrical and power equipments of many buildings and industrial plants. During the war they acted as consult-

J. R. CRAVATH

ing engineers for steam and electrical equipment for naval projects and were also engaged on steam work for three United States air nitrate plants and the Raritan Arsenal and on shipyard work for the Emergency Fleet Corporation.

Obituary

Henry M. Norton, president of the Norton Electrical Company, Manchester, Conn., died of pneumonia on April 30. Mr. Norton was associated with his brother in the manufacturing of electrical instruments. He was forty-three years old.

Col. Richard H. Abbott, president of the Abbott Light & Power Company, Petersburg, Ill., died May 3 in a Springfield (Ill.) hospital, where he was recently taken to undergo an operation for appendicitis. Mr. Abbott was secretary of the Illinois Electric Light Association. He was a lieutenant-colonel in the Quartermaster's Corps of the State Adjutant General's staff and a major on the staff of Governor Lowden of Illinois. Colonel Abbott saw service in the Spanish-American War. He was forty-nine years old.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

FACTORS THAT FIGURE IN INCREASED JOBBING COSTS

Higher Wages Play a Part in Jobbers' Costs and Indicate that Greatest Advance Is Given to Store Salesmen

Figures collected from about sixteen jobbing houses show clearly the trend of costs in wholesale electrical establishments. During the period over which the data were taken the operating expenses increased about 7.5 per cent, and the total volume of business based on money values dropped off about 3.5 per cent. The data showed very distinctly that wage increases had been granted to all classes of employees. The following table gives a summary of the averages calculated from the detailed data:

Classes of Employees	Present Salary or Expenses per Month in Dollars	Increases in Per Cent.
Stenographers (salary)	91	15
Typists (salary)	70	15
Country salesmen (salary)	200	11
Country salesmen (expenses)	165	11
City salesmen (salary)	170	12
City salesmen (expenses)	45	19
Store salesmen (salary)	105	24

There appeared to be no opinion that the present wages were unduly high nor was there an expressed sentiment toward reduction by any jobber. The general feeling was that prices of living which made the increases necessary are still present, and that in justice to employees increases should remain at least for the present.

Income taxes last year for jobbers amounted, generally, so far as has been stated, to 2 per cent of the sales and will, it is thought by jobbers, be more this year. Some companies are considering this tax as an added cost of doing business and are adding to the selling price of all goods a fixed percentage which is calculated to cover the tax for this year.

IMPROVED DISTRIBUTION OF INCANDESCENT LAMPS

More Lamps Sold in Greater New York Since Central Stations Discontinued "Free" Renewals than Were Previously Sold and Renewed

It has been shown in New York City that under proper conditions more lamps can be sold by the central stations, jobbers, contractor-dealers and manufacturers working together than the central stations are able to dispose of under their renewal or combined sale and renewal policies.

The success of the unrestricted sale of lamps was found to be contingent upon the territory being adequately covered by retail merchants, such as electrical contractor-dealers, hardware stores and other retailers, who combine the qualities of merchants with sufficient knowledge of the lamp business to give customers the right service. When the New York Central stations took the price of lamps out of their rate schedule and advised their customers that lamps would have to be purchased separately in future there was not a sufficient number of this class of dealer in the field, and as a result the number of lamps delivered into the district by the manufacturers began to drop off. Grocery stores, drug stores and other retailers signed lamp contracts and put lamps on their shelves for their regular salesmen to sell. These untrained lamp merchants did not improve distribution; in fact, it is claimed that they made matters worse. They so often sold lamps of incorrect size or voltage that their customers became disgusted and did not buy lamps until it was absolutely necessary.

A committee of all branches of the electrical industry interested in the sale of lamps in New York City was organized to grapple with the problem after the lamp business had been allowed to drift for about six months. A canvass was first made of all the lamp agents in the district, and about one-half were crossed off the manufacturers' list either because they were not actively engaged in the sale of lamps or because they had gone out of business. Steps were then taken to place lamp contracts with agents who could give the public proper service and who were established in parts of the city not adequately served. Some of the retailers who gave their lamp customers good service were nevertheless not conversant with the most modern selling methods. These people were taken in hand by the manufacturers, who taught them how to dispose of lamps to the best advantage.

The coördinated efforts of the committee have changed the number of lamps disposed of in the district from minus to plus quantity compared with a year ago when the free-renewal policy of the central station was in effect. Although the central stations are only selling from 25 to 40 per cent of the lamps they formerly delivered to their customers, the total number of lamps now being supplied to the district is probably 50 per cent greater than it was last year. The manufacturers' receipts from a large number of comparatively small contracts at a list price 10 per cent in excess of last year's figures show 100 per cent increase over a similar period in 1918.

TRANSFORMER RAW MATERIALS COSTS DOUBLE THOSE OF 1914

Review of Increases with Respect to Selling Price Seems to Indicate that No Further Price Recessions Are Scheduled

The approximate percentages of increase in the prices of materials entering into the manufacture of transformers in 1919 over the prices of the same material for 1914 are set forth in the following table:

Material	Approximate Percentage of Increase
Sheet-iron laminations	100
Copper wire	150
Copper sheets	100
Cases and covers	125
Cotton tape	300
Insulating compounds	60
Hardware (iron)	160
Hardware (copper)	120
Hardware (brass)	200
Hardware (porcelain)	60
Lumber for crating	80

It is apparent from this table that the cost of the principal raw materials involved in the manufacture of transformers will average over 100 per cent above the cost of the same materials in 1914. The effective increase in the price of transformers which has taken place during that time amounts to something like 40 per cent. It appears, therefore, that the ability to market transformers at an

increase of only 40 per cent as against 100 per cent increase in the cost of material must have been due to some striking increase in efficiency. In most cases it was due to the application of principles of greater efficiency in the factory and to the application of methods involving a lower percentage of overhead in handling the business. It may be expected that some of the materials listed in the table will go down to some extent in the future, but in the majority of cases the labor is not being reduced in price; moreover, the load factor on transformer orders has fallen off considerably. In view of all these circumstances and after having discussed the matter with some manufacturers of transformers, it does not appear probable that there can be a much further reduction of transformer prices during the year 1919.

METAL MARKET SITUATION

Nearly All Metals Advance in Price—Copper at 16.75 Cents—Demand Better

The expected improvement in the metal market has set in. There is hardly a base metal the price of which has not increased in the last week. The whole tone of the market is one of greater stability.

The improvement in copper is most decided. Two weeks ago, when the upward movement set in, copper was 15.37½ cents a pound, while to-day it has advanced to 16.75 cents. Much was purchased last week for both foreign and domestic use. Foreign sales for May are expected to double those for April. There is considerable room for improvement, however. Wire base has advanced in the neighborhood of a cent, and London spot has increased £3. The price of 18 cents domestic is looked for in June, according to some authorities. The copper market to-day has been termed the most favorable since consumption fell off after last November. It is expected the early extension of foreign credits will cause renewed foreign buying.

Much interest has been shown lately for tin for delivery as soon as possible. London quotations on spot tin have increased nearly £10 the last week. American manufacturers are apparently preparing for a lifting of the embargo which will permit the importation of that metal to the States.

Lead has advanced in the New York market to 5.25 cents. The advance came as a surprise to buyers who were not especially well stocked. The demand has increased. Antimony increased seven-eighths of a cent, but the demand is rather light.

The scrap market in coppers, brass, lead and zinc has followed the upward trend of the new metal market. Scrap dealers are reported buying new metal on speculation. They are very optimistic in their expectations for the future.

NEW YORK METAL MARKET PRICES

	May 13	May 20
Copper:	£ s d	£ s d
London, standard spot	76 5 0	79 5 0
	Cents per Pound	Cents per Pound
Prime Lake	16.00 to 16.25	17.00
Electrolytic	16.00	16.75
Casting	15.37½	16.00
Wire base	17.25 to 18.00	18.00 to 18.50
Lead, trust price	5.00	5.25
Antimony	7.12½	8.00
Nickel, ingot	40.00	40.00
Sheet zinc, f. o. b. smelter	10.00	10.00
Spelter, spot	6.40	6.65
Tin	Govt. price 72.50	Govt. price 72.50
Aluminum, 98 to 99 per cent	32.00	32.00 to 33.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	13.50 to 14.00	13.75 to 14.25
Brass, heavy	7.50 to 8.00	7.75 to 8.25
Brass, light	6.50 to 7.00	7.00 to 7.25
Lead, heavy	4.25 to 4.37½	4.37½ to 4.50
Zinc, old scrap	4.00 to 4.25	4.50 to 4.75

THE WEEK
IN TRADE

GENERAL business conditions indicate a gradual returning to a more stable basis. Retailers are enjoying continued activity, but jobbers' prosperity is somewhat spotty. Jobbers in different sections of the country have or have not satisfactory activity according to the industries which prevail in those sections.

Reports of building activities are becoming more favorable each week. No spectacular booms have started, but a healthy amount of construction is under way. Most of this, however, is of the residential type, due to housing conditions in and near the cities.

Stocks of nearly all materials are in good shape, both factory and local. Vacuum cleaners and flexible armored conductors prove the greatest exception to this rule. Deliveries to jobbers are improving, and prices in general are holding firm. Collections of all classes appear to show continued improvement.

NEW YORK

The general tone of business in this section shows improvement. This seems to be more true of manufacturers than of jobbers. Opinion among the latter is somewhat unsettled. Reports of satisfactory buying come from some jobbers, while from others the reports are not quite so good. Not all are of the opinion that the month of May is showing up as well as the month of April, so the conclusion may be drawn that buying is spasmodic and localized in spots.

Armored conductor and fittings, the materials principally used in wiring old houses and new ones, are having a heavy run, while rigid conduit and fittings for commercial and apartment buildings are still rather slow. Fans are moving better. Rubber-covered wire is picking up in manufacturers' sales.

There is a much better tone in the building market. For commercial buildings the borough of Queens gives the greatest promise in number of large projects already under way or about to start. Remodeling of used plants also figures in that section. Throughout several suburban districts near New York City come reports of improvement in house building. This is quite noticeable in driving through the country.

FLEXIBLE ARMORED CONDUCTOR.—Large demands from all sections are piling up on manufacturers to the extent that the orders cannot be filled promptly. Jobbers' stocks are low, and they apparently were unprepared for the rush which is now on. Fittings and boxes for this conduit are not moving so fast as might be expected. They are in better supply than the conduit.

RIGID CONDUIT.—Jobbers are finding spotty markets. One prominent jobber reports a satisfactory market, while others report little movement. Prices are steady at present, but an upward tendency has been predicted in one case. Heavy buying is expected in the early fall.

OUTLET BOXES.—A somewhat better demand is found, although nothing of a startling nature.

LIGHTING FIXTURES.—Lighting fixtures, sockets, cutouts, switches, etc., for outdoor use, the product of one manufacturer, are reported down 5 per cent early in May.

LAMPS.—Sales are holding up well for this season. Stocks of 100-watt tungsten lamps have been reported in better shape. Stocks in general are in a good condition and deliveries are satisfactory.

MARINE GENERATING SETS.—The Emergency Fleet Corporation received bids in Philadelphia, on May 17, for 125 and 175 15-kw. direct-current engine-driven marine

sets. The government's decision to carry out its marine work is encouraging to the trade.

SCHEDULE MATERIAL.—No special movement has been found in this line, although small amounts have gone with the purchasing of conductors.

RUBBER-COVERED WIRE.—Nine manufacturers are quoting on a 20-cent base, one on 19 cents, one on 18 cents, one on 24 cents and one on cost. The tendency seems to be to stiffen in price rather than recede.

CHICAGO

General conditions surrounding the outlook for more construction appear better, but the general labor situation has not improved. Brick prices have been shaded. The City Council is again active on the problem of electrifying the Illinois Central terminal and suburban railroad, but it is difficult to tell whether anything material will come out of this or not. The steel mills in the Chicago district are working only from 25 per cent to 40 per cent full time.

The Willys-Overland strike has not been settled yet; a milk drivers' strike in Chicago, based on a demand for $4 per week increase in wages, has been settled. There have been other minor disturbances.

Building activities are about one-half what they should be at this time of the year, the total permits for the week running $1,215,600. Buildings projected total $3,825,000.

FARM-LIGHTING PLANTS.—It has been stated that the Electric Auto Lite Company, which is affiliated with the Willys-Overland Company, Toledo, will soon be ready to market a farm-lighting plant.

COPPER WIRE.—Bare and weatherproof copper wire were somewhat stronger this week, the bare advancing about ½ cent. Rubber-covered remained the same.

CONDUIT.—There has been no change in conduit prices.

FLASHLIGHTS.—The manufacturers have changed the list price on flashlights about 20 per cent.

INSULATORS.—There has been some price cutting in standard porcelain, but there has been no change in high-tension insulators, except for a slight advance in guy strain insulators.

METERS.—The business in meters is picking up. Revamping of old buildings, replacing of gas lighting and work of this sort, particularly in Chicago, is active. Some manufacturers' associations in the Middle West are being formed for the purpose of building workmen's houses, and this has also increased the demand for meters. The 5-amp. type is the most active.

ELECTRIC RANGES.—One manufacturer asserts that he has sold more ranges so far this year than he ever has in the first six months of any proceding year.

SYNCHRONOUS MOTORS.—The practice of using synchronous motors on ice machines continues to grow, one large installation of this character tested in Chicago recently having proved very satisfactory.

VACUUM CLEANERS.—The Hoover Suction Sweeper Company reports the sale of $100,000 worth of cleaners to the Denver Gas & Electric Company and $182,000 worth to the Sanger Department Store of Dallas, Tex. Both of these concerns it is expected will reorder before the end of the year.

MOTORS.—Inquiries and business are both picking up in the Chicago territory, the greater part of the demand being for sizes of less than 100 hp.

ELECTRIC FIRELESS COOKERS.—Manufacturers producing electric fireless cookers retailing at around $35 are making a strenuous effort to make central stations and dealers see the long profit in handling this class of goods. Considerable success is attending their effort.

SMALL THREE-PHASE MOTORS.—Reduced prices were placed in effect on April 19 on Emerson 1-hp. and 2-hp., three-phase motors. The price reduction amounted to 10 per cent in the case of 1-hp., 110-volt and 220-volt, 60-cycle, three-phase motors and 20 per cent on the 2-hp., 110-volt and 220-volt, 60-cycle, three-phase motors.

BOSTON

Business is somewhat quieter this week among jobbers, although trade in specialties holds up well. Automobile supplies are moving fast. Prices are firm, with slight upward tendencies in some products. Fractional-horsepower motors are a little easier, and an advance in wire is expected shortly. Stocks are in fair shape to meet present demands, but would probably soon be heavily depleted if buying should set in on a big scale. Collections are somewhat improved over last week. Deliveries are very satisfactory with the exception of a few prominent makes of vacuum cleaners, which are low in local stocks. Armored flexible conduit is also short. Contractors are occupied chiefly with renovation jobs. Building work is handicapped by labor demands. Consulting engineers are active on report and "proposition" work, and here and there some central-station construction work is being handled. The electric railway market is dull, but the Boston elevated is spending about $1,000,000 on track construction and betterment and has comprehensive plans for a total improvement program of about $20,000,000 in the next five years.

Bids were to be opened Monday by the New England Power Company at Worcester, Mass., covering the cost of installing 12,000 kva. in waterwheel generating units, transformers and electrical equipment for the enlargement of the company's 20,000-kw. hydroelectric plant at Vernon, Vt.

WIRE.—Armored flexible cable is scarcer, and the demand is increasing. Early advances in the price of bare weatherproof and slow-burning wire are forecast. The shortage in non-metallic flexible conduit is relieved.

ELECTRIC RANGES.—The demand is increasing rapidly, and it is practically impossible now to accumulate factory stocks.

FANS.—Fan movement showed some increase in response to warmer weather a week or so ago, but soon dropped back to a quiet market. The indications are that local stocks will soon be exhausted if protracted hot weather hits New England.

SEWING MACHINES.—Trade reflects keen competition and a fair demand. The volume of trade fell off with the diminution of Red Cross and related war work, and a full recovery has not been attained. A recent advance in Western Electric No. 1 outfits of $1.05 is noted at wholesale, and this led to a retail increase of about $5 in some units, the stores feeling that their percentage of profit should be increased in view of present economic conditions.

FLATIRONS.—A steady demand is noted, but some factory stocks are now reported to be established.

VACUUM CLEANERS.—The demand is very heavy, and increased manufacturing facilities appear necessary to restore satisfactory deliveries in two prominent makes.

LAMPS.—Stocks are in excellent condition. The demand holds up better than might have been expected at this season. Miniature and sign lamps are greatly improved in deliveries, and in most cases exceedingly prompt shipments can be made.

INDUSTRIAL ELECTRIC TRUCKS.—Inquiries have begun to increase again, and a better feeling dominates the local market. Prices are steady and deliveries on a satisfactory basis. It looks as though sales would shortly show much improvement.

STORAGE BATTERIES.—The automobile trade is brisk. Local stocks are better than for a long while, and one prominent dealer states that he is now ahead in his stock for the first time in three years. The demand for industrial batteries is a bit dull at the moment, although there is a better outlook in the truck field.

MOTORS.—Sales are not up to the mark of last year, but in some cases orders compare favorably with pre-war volumes. Fractional-horsepower motors are easier in price, perhaps 5 per cent lower than a fortnight ago. The second-hand motor market does not appear to be making much disturbance in prices. Stocks are on the whole pretty well prepared for future demand, barring occasional gaps in the listings. By and large, the market is somewhat dull, but the feeling is strong that better times are not far away.

ATLANTA

The week's most significant features are not the clear evidences of further business recovery, steadily widening its area, but rather those political events which foreshadow a lessening of uncertainties that have been influential in retarding a full measure of economic development. Residence and apartment construction is gaining. This with the erection of manufacturing plants in the Southeast makes for increased demand on dealers and contractors. Requirements for schedule material appear to be increasing as evidenced by a more active movement this week. The American Cotton Export Financing Corporation has been formed this week, capitalized at $100,000,000. This company will export cotton, handle foreign securities and erect cotton warehouses throughout the South.

POLES.—The market is holding up well and jobbers report a satisfactory trade. Drop shipments direct from Western stocks to consumers are prompt. Prices are steady.

RANGES.—Very little activity is noted in this line; in fact, trade in these has been dormant for the past two months. Factory shipments are good.

CABLE.—The buying undercurrent is strong and business is becoming more active. Industrial demand has developed beyond expectations. A 20-cent base prevails for weatherproof and rubber-covered. Inquiries are out for three-conductor lead-covered for 19,000 volts. Shipments are improving.

INSULATORS.—Glass insulators are quoted a shade off the market, with an increased call and good shipments. An improvement is noted in porcelain, but prices are somewhat unsettled.

FLASHLIGHTS.—While the volume of business is fairly satisfactory, a decrease in sales is noted over the previous week. Stocks are ample and incoming shipments are tending to swell normal stocks. Retail prices on certain items are off 10 cents this week.

FANS.—A shortage of 32-volt fans for farm-lighting outfits is noted. As jobbers and dealers are absorbing the 5 per cent tax, no change in price has been made to the final user. Shipments to outlying points on stock orders are moving more rapidly.

LAMP CORD.—The coming fan season has stimulated this line and manufacturers report increased movements. Local stocks have been built up well. An 18-cent base covers the market.

OUTLET BOXES.—These are going slow and a moderate demand only is evident. Prices are remarkably firm. Jobbers are pretty well stocked up and Eastern shipments are coming in promptly.

ARMORED CABLE.—Prices have sagged and regained their former position in a short time. With the exception of a shortage in a few sizes, deliveries are good. Jobbers expect the market to widen as apartment-house construction advances. The volume of transactions shows a slight increase.

SEATTLE—PORTLAND

Persistent reports that the completion of present contracts for steel ships in Seattle and Tacoma yards early in the fall will terminate shipbuilding on the present large scale is seriously affecting all lines of industry, including electrical business. The hope is held out that canceled contracts will be reawarded for a larger type of vessels, although nothing definite can be ascertained. In spite of present conditions, jobbers are optimistic, believing that renewed activity awaits only assurances that shipbuilding is to be continued. Sales of consequence during the past week have been very light. Government buying is almost at a standstill. Domestic appliances sales are moving fairly well. The tentative lifting of the ban on foreign ship contracts may mean that the Foundation Company of Tacoma and Portland will be able to bring back the order for 174 steel ships which it holds from the French government. The contract will approximate $200,000,000.

Northwest lumbermen declare that the lumber industry is about to come into its own with the resumption of peace and the restoration of normal conditions of business. The tendency toward the electrification of lumber plants and flour mills has resulted in an unusual number of motor inquiries, indicating a renewed interest. In some cases good-sized orders have been placed. With a few exceptions stocks are in excellent shape. There has also been some slight demand for small motors for new grain elevators in eastern Washington. The wire demand is continually decreasing, particularly for the type used in shipyards. Recently rural central stations absorbed a considerable amount for extensions and maintenance, particularly the latter. The volume of residence construction under way in this section is also demanding a good supply of wire. Stocks are good.

Storage batteries, owing to an increasing automobile demand, jobbers report, show a fairly brisk trade. This year's sales volume to date has exceeded all expectations. Stocks are in fair shape and prices show no change. Ornamental lighting inquiries from rural communities are becoming more numerous, and it is believed a satisfactory volume of sales will result. Several good-sized lighting projects which have been held up during the war period will be undertaken in small towns in this vicinity during the summer. Stocks of insulators are good, but the demand is considerably lighter than at any time during the past two years. Prices remain firm. The conduit demand from shipyards, while of hand-to-mouth variety, presents a satisfactory total.

SAN FRANCISCO

Business is still exceedingly good, running in most cases over last year's business in volume. This is somewhat surprising and unexpected. The building boom has still failed to materialize, although there are unmistakable indications that the disinclination of builders to buy at the present market prices is being broken down. Crops are steadily ripening and promise to be of the bumper variety. Credits and collections are fair and stocks and shipments good. Altogether it is a period of optimism.

LAMPS.—Business is showing signs of the usual midyear cut-down, and this fact and also the fact that the lamp factory is running at its pre-war strength in quantity and quality have brought back orders down to a minimum.

SCHEDULE MATERIAL.—This class of material is moving steadily though slowly and thus far remains fairly constant in price. The bulk of the present sales work is being directed toward architects and engineers because the jobs have not yet reached the stage of actual preparedness for dealers and contractors.

MARINE AND SCHEDULE MATERIAL.—This class of material has dropped in demand and will decrease more. To the Eastern factory styles must be added numerous local makes which combine to glut the market.

HEATING MATERIAL.—Practically all standard household flatirons are now listed at $6.50 each, several makes recently falling into line with the market. In general, it may be said that, in spite of the efforts of intensive solicitation, the heating business is poorer this year than in previous years.

MEASURING INSTRUMENTS.—Prices on some makes are slightly better, but deliveries are wonderfully improved, owing to the factories' release from government contracts. The former six months' time for a shipment has now been cut to less than a quarter.

CONDUIT AND FITTINGS.—The market is quiet. Stocks are good and prices fairly steady.

SEWING MACHINES.—Eastern stocks of various manufacturers are being supplied, and the sewing-machine field is rapidly becoming as highly competitive as the washing-machine field. Prices have recently advanced to the consumer, the standard three-quarters-head vibrating model now retailing for around $47 each, but prices to dealers have remained steady, the extra margin allowing them to make exchanges, etc.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit.

Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

No. 14 Solid	
Less than coil	+10% to 20%
Coil to 1000 ft	List to 25%
No. 12 Solid	
Less than coil	+10% to 20%
Coil to 1000 ft	List to 25%

Twin-Conductor

No. 14 Solid	
Less than coil	+10% to 20%
Coil to 1000 ft	List to 25%
No. 12 Solid	
Less than coil	+10% to 20%
Coil to 1000 ft	List to 25%

DISCOUNT—CHICAGO

Single-Conductor

No. 14 Solid	
Less than coil	+20%
Coil to 1000 ft	List
No. 12 Solid	
Less than coil	+20%
Coil to 1000 ft	List

Twin-Conductor

No. 14 Solid	
Less than coil	$115.00
Coil to 1000 ft	100.00
No. 12 Solid	
Less than coil	+20%
Coil to 1000 ft	List

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+30% to List
1/5 to std. pkg	+5% to 20%
Std. pkg	18% to 36%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.45—$0.46	$0.45—$0.47
12 to 50	.40	.40— .41
50 to barrel	.35— .36	.36— .37
Barrel lots	.32— .329	.33— .339

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.45	$0.45
12 to 50	.38	.38 to $0.39
50 to barrel	.35 to $0.362	.35 to .372
Barrel lots	.326 to .332	.326 to .342

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
⅜	250	$5.00
½	250	7.50
⅝	100	10.00
¾	50	13.00
1	50	21.00
1¼	50	26.00
1½	25–50	35.00
2	25–50	45.00
2½	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less than Coil	Coil to 1000 Ft.
⅜-in. single trip	$75.00	$63.75— 69.75
⅜-in. double strip	75.00— 82.50	72.00— 75.00
½-in. single strip	100.00	85.00— 93.00
½-in. double strip	100.00—110.00	96.00—100.00

NET PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 1000 Ft.
⅜-in. single strip	$75.00	$63.25 to $63.75
⅜-in. double strip	78.25 to $78.75	71.25
½-in. single strip	100.00	75.00 to 85.00
½-in. double strip	105.00	93.00 to 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
⅜	$0.05½	1	$0.25
½	.06	1¼	.33
⅝	.09	1½	.40
¾	.12	1¾	.47
⅞	.15	2	.55
1	.18	2½	.65

NET PER 1000 FT.—NEW YORK

	Less than $15 List	$15 to $60 List	$60 to $150 List
⅜-in.—	$25.00	$18.00	$16.00
½-in.—	30.00	19.50	17.50

NET PER 1000 FT.—CHICAGO

	Less than $15 List	$15 to $60 List	$60 to $150 List
⅜-in.—	$60.00	$30.00	$26.00–26.50
½-in.—	65.00	32.00–32.50	29.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 40

Size, In.	Conduit, List per Foot
¼	$0.08½
⅜	.08½
½	.08½
¾	.11½
1	.17
1¼	.23
1½	.27½
2	.37½
2½	.58½
3	.76½

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
¼	$0.05	$0.19
⅜	.06	.19
½	.07	.19
¾	.10	.25
1	.13	.37
1¼	.17	.45
1½	.21	.50
2	.28	1.10
2½	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	4% to 12.1%	6% to 14.1%
2500 to 5000 lb.	9% to 15.1%	11% to 17.1%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ to ½ In.	¾ to 3 In.
Less than 2500 lb.	+3%	+1% to 2%
2500 to 5000 lb.	+1% to 2%	+4%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$7.00 to $7.50
Discount	25%

CHICAGO

List price	$6.35 to $7.50
Discount	20% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	30%
1/5 to std. pkg	41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	30%
1/5 to std. pkg	40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg	$6.00 to $8.75
1/5 to std. pkg	5.50 to 7.00

Standard packages, 500. List, each, $0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg	$8.00
1/5 to std. pkg	7.00

Standard packages, 500. List each, $0.07

LAMPS, MAZDA OR TUNGSTEN

110 to 125 Volts

Regular, Clear:	Std. Pkg.	List Each
10 to 40-watt—B	100	$0.35
60-watt—B	100	.40
100-watt—B	24	.85
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2.20
300-watt—C	24	3.25
Round Bulbs, 3½-in., Frosted		
15-watt—G 25	50	.60
25-watt—G 25	50	.60
40-watt—G 25	50	.60
Round Bulbs, 3½-in., Frosted:		
60-watt—G 30	24	.82
Round Bulbs, 4½-in., Frosted:		
100-watt—G 35	24	1.15

DISCOUNT—NEW YORK

Less than std. pkg.	List
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	List
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$35.01–$35.18
Coil to 1000 ft	25.94–29.17

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30.00—$36.00
Coil to 1000 ft	21.00—27.00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$29.70 to $33.00

CHICAGO

Net per 100	$33.00

OUTLET BOXES

Nos.	List per 100
101—A, A 1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S.	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S., 1½, 3 R	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	26%–38%	20%–33%
$10.00 to $50.00 list	36%–47%	31%–43%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	20%–32%	10%–27%
$10.00 to $50.00 list	30%–40%	20%–35%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$15.00 to $22.40
1/5 to std. pkg.	12.00 to 15.35
Standard package, 2200. List per 1000, $21 to $34	

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$21.00–$24.15
1/5 to std. pkg.	17.85–21.00
Standard package, 2200. List per 1000,	$20.00

PORCELAIN KNOBS

NEW YORK

Per 1000 Net.	Std. Pkg. 3500.	Std. Pkg. 4000
	5½ N.C.—Solid Nail-it—N.C.	
Less than 1/5 std. pkg.	$13.60–$15.00	$22.00–$22.40
1/5 to std. pkg.	10.50–11.20	15.35–18.00

CHICAGO

Per 1000 Net.	Std. Pkg. 3500.	Std. Pkg. 4000
	5½ N.C.—Solid Nail-it—N.C.	
Less than 1/5 std. pkg.	$13.00–$18.40	$32.00–$36.80
1/5 to std. pkg.	11.50–16.00	27.20–32.00

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
⅛-in. cap key and push sockets	500	$0.33
⅛-in. cap keyless socket	500	.30
⅛-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	+20%
1/5 to std. pkg.	List

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	List
1/5 std. pkg.	List to 10%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	$0.42
60-amp. S. P. S. T.	.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+15%
$10 to $25 list	2%
$25 to $50 list	5%
	Low Grade
Less than $10 list	+5%
$10 to $25 list	8%
$25 to $50 list	15%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+25%+15%
$10 to $25 list	+10% to 2%
$25 to $50 list	+5% to 5%
	Low Grade
Less than $10 list	+15% to +5%
$10 to $25 list	2% to 8%
$25 to $50 list	5% to 15%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind	250	32
10-amp. single-pole	100	48
10-amp. single-pole, ind	100	54
5-amp. three-point	100	54
10-amp. three-point	50	76
10-amp., 250-volt, D. P.	100	66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	70
10-amp. double-pole	50	.70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	+20%
1/5 to std. pkg.	List
Std. pkg.	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to list
1/5 to std. pkg.	List to 10%
Std. pkg.	8% to 23%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	18%–20%	List–18%
$2.00 to $10.00 list	28%–30%	5%–28%
$10.00 to $50.00 list	45%–50%	10%–47%

DISCOUNT—CHICAGO

	Galvanized	Black
Less than $2.00 list	25% to 40%	20% to 30%
$2.00 to $10.00 list	25% to 50%	20% to 40%
$10.00 to $50.00 list	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price	$6.00 to $7.00
Discount	25%

CHICAGO

List price	$6.35 to $7.00
Discount	20% to 30%

WIRE, ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.39–$0.41
No. 18, full spools	.35–.37

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.53 to $0.90
No. 18, full spools	.47 to .64

WIRE, RUBBER-COVERED, N. C

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$14.15–$14.50	$10.50–$12.65	$10.50–$10.60
12	$18.18	18.18	$13.64
10	24.30	24.30	16.20
8	33.12	27.60	22.08
6	52.50	43.75	35.00

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$17.50–$20.00	$9.50–$15.00	$9.50–$13.00
12	17.50–21.63	17.55–21.63	17.55–18.54
10	24.05–28.91	24.05–28.91	21.16–24.78
8	33.35–39.34	33.35–33.72	29.35–33.72
6	52.95–61.74	46.60–52.92	46.60–52.92

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb	$24.00–$29.25
25 to 50 lb	24.00–25.25
50 to 100 lb	23.00–23.25

CHICAGO

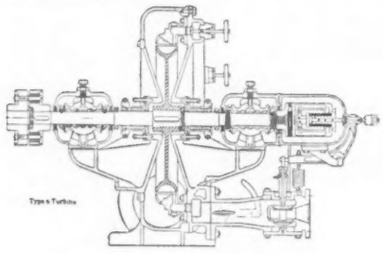
	Per 100 Lb. Net
Less than 25 lb.	$23.75 to $35.75
25 to 50 lb	23.75 to 34.75
50 to 100 lb	23.75 to 37.35

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Steam Turbines

For direct connection to blowers, fans, electric generators and centrifugal pumps, type 6 steam turbines are now being offered by the B. F. Sturtevant Company of Hyde Park, Boston.



CAN BE DIRECTLY CONNECTED TO GENERATORS, PUMPS, ETC.

They are said to retain the fundamental features of previous types made by this concern and in addition embody numerous refinements in detail construction.

In operation, steam enters an annular steam chamber in the turbine's casing through a balanced throttle valve, and from this chamber it passes through nozzles to the bucket wheel or rotor. The steam is said to leave the nozzles at a high velocity, since they expand it to a pressure equal to the exhaust pressure in the turbine casing. At this high velocity the steam then impinges against the semicircular rotor buckets, imparting full impulse to the rotor, and leaves the bucket in a reverse direction. As it leaves the rotor the steam enters the semicircular reversing buckets, which are cast in one piece with the nozzles, thus again reversing the direction of the steam and driving it back into the rotor. The steam enters and leaves the rotor in a circular motion several times before its kinetic energy is absorbed and its velocity dropped to that of the rotor. When this occurs it passes out into the exhaust.

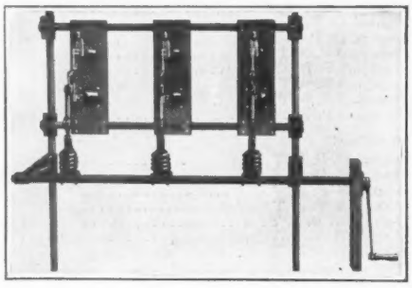
These turbines are constructed with standard rotors of 12, 18, 24, 30 and 36-in. (30, 45, 60, 76 and 90-cm.) diameter.

Three-Pole Remote-Control Disconnecting Switches

For use where "disconnects" must be operated quickly and safely or in congested locations, the Delta-Star Electric Company, 2433 Fulton Street, Chicago, has developed a three-pole interlocked remote-control disconnecting switch. It is intended for mounting on walls or pipes in compartments or in open work. When mounted in compartments the operating shaft extends through the wall, a face plate covering the opening.

When the operating handle is in the open or closed position it rests against position stops which are cast on the face plate. As this handle can be removed the necessity of a lock is eliminated. Minimum effort is required for operating the switch because of the lever arrangement. Double insulation is secured between the live parts and the ground as the connecting levers consist of porcelain insulators connected with impregnated wood sections.

Auxiliary indicator switches can easily be attached to the operating shaft, thereby permitting the use of position pilot lamps on the switchboard or at any other point. By altering the length of the wooden rods the mounting height above the floor can be varied to suit local conditions. The over-all dimension from rear of base to the most extended point of the switch is 21 in. (53 cm.) with the switch blades in open position. The use of narrow aisle space is thus permitted.



LEVER ARRANGEMENT MINIMIZES EFFORT NECESSARY TO OPERATE SWITCH

Screwdrivers for Use on High Voltages

With handles formed of insulation said to resist current as high as 5000 volts, "Hyvoltage" screwdrivers are being made by the Strong Machinery & Supply Company of 21 Walker Street, New York City, in three styles. In the regular electrician's type the insulation extends nearly three-quarters of the blade's length to prevent the fingers from touching the metal; in the switchboard type for line work the insulation is extended to within $\frac{1}{2}$ in. (1.3 cm.) of the end, in which the blade is narrowed to $\frac{3}{8}$ in. (0.9 cm.) in order to prevent short-circuiting of the lines when working between them. The third style is the garage type for auto work.

These tools are said to be waterproof, infusible and to have a low coefficient of expansion. Grooves are cut deeply in the handles to insure a firm grip, and the blades are embedded to the center of the handle to give greater strength.

Electrically Heated Suits for Aviators

For enabling aviators to withstand extreme cold occurring at high altitudes and on lower flights during cold weather, electrically heated clothing has been developed by the Simplex Electric Heating Company of Cambridge, Mass.

The energy required to heat these suits is 80 watts, disposed as follows: Helmet, 20 watts; each glove, 16 watts; each moccasin, 14 watts. The energy is supplied at 12 volts, either from a storage battery or from a small fan-driven generator of stream-line shape mounted on the airplane, the fan being rotated by the passage of the plane through the air. The heating elements are flat loops of resistance wire spaced about seven per inch and about $\frac{9}{32}$ in. (7 mm.) wide per row. They are machine-sewed on a cotton cloth base, the cotton thread being carried along the top and bottom of each row of loops parallel to the horizontal axis of the row. Flexibility results from this mounting, and the base can be stretched or crumpled at will without danger of breaking the wire. Each heating element is composed of

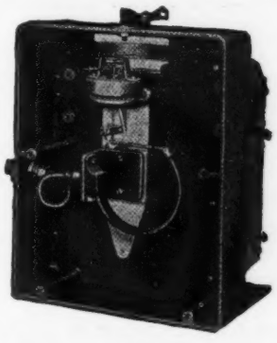
ENERGY SUPPLIED FROM STORAGE BATTERY OR AIR-DRIVEN GENERATOR

two bare wires in contact with one another throughout a considerable part of every loop, so that if a break occurs in any one wire, the effect is merely to force the small amount of energy concerned through a conducting path of smaller cross-section between the break and the nearer points of contact. One unit is provided for the helmet, and this with four units required for gloves and moccasins is wired in multiple. There are three circuits per suit, and the warming of hands, head and feet is controlled at a Hart & Hegeman push-button switch mounted near the pocket on the right side of the trousers. The supply of energy is provided through a plug and rubber-covered cable leading from the control switch to the source of electricity.

The suits are lined with "Nuback," a non-inflammable artificial wool, and with "Kapok," a cork-like material which facilitates floating in water. Outside waterproofing is also provided, and the gloves are silk-lined on each side of the heating element. The heating elements are arranged to warm the back of the head, the facial parts around the ears, across the forehead and across the mouth, along the side and under part of the sole of the foot and along the fingers and thumbs. A small opening is left in the side of the helmet for a telephone receiver.

Graphic-Pressure and Vacuum Recorder

The graphic-pressure and vacuum-recording instruments which are being made by the Esterline Company of Indianapolis, Ind., resemble the "type MS" ammeters and voltmeters made by this company. In this instrument, however, a pressure-measuring instrument is used as a meter element. These recorders can be furnished in various ranges up to 2000 lb. per square inch (140 kg. per sq. cm.). A feature in their construction is the pen tube. Removing this for cleaning, for inserting a new pen or for changing the pressure on the recording chart is accomplished by simply lifting the pen from its stirrups without any necessity of opening

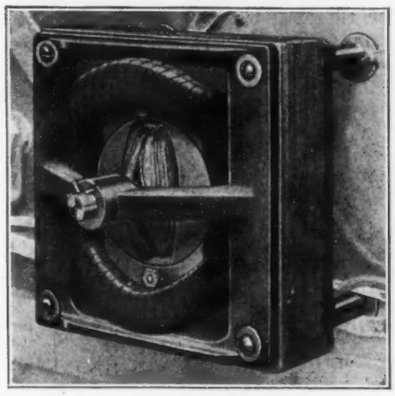


REAR VIEW OF RECORDER WITH COVER REMOVED

the compartment containing the meter element. The meter element is placed in the rear compartment of the instrument case, and the pen tube projects through into the front compartment, which contains the clock and the chart-feeding mechanism. The maker also calls attention to the non-spillable ink well used in this instrument. Only the front cover need be opened to replenish the supply of ink since filling tubes project through the compartment wall, making unnecessary the opening of the meter compartment.

Induction Regulators

Particularly designed for maintaining definite values of current or voltage during tests or comparisons of alternating-current electrical instruments, induction regulators are being marketed by the States Company of 72 Francis Avenue, Hartford, Conn. In calibrating indicating instruments they are said to be very convenient for holding constant indications at the points of the scale to be compared. They may be put to other uses not only in the electrical testing laboratory but in any application where it is desired to con-



AUXILIARY AUTO-TRANSFORMER CAN BE USED TO INCREASE VOLTAGE RANGE

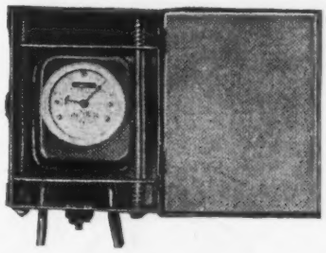
trol voltage or current and the amount of power involved is small.

A laminated steel core having a stationary part and a movable part, resembling very closely the structure of a direct-current motor, comprises the regulator. On the stationary part is a primary winding which may be connected to a source of constant voltage. On the movable member is a secondary winding in which a voltage is generated, in value varying from zero to a maximum, depending upon the position of the movable part. A small hand wheel serves to turn the movable part of the core and to enable the operator to adjust the current or voltage as desired.

These regulators have a 100 volt-ampere capacity. The primaries are wound for 110 volts and 220 volts, 25, 40 or 60 cycles. The maximum secondary voltages are 11 and 110 and the maximum secondary amperages 1 and 10. The regulators may be wound for other voltages and current if desired. Two styles of these regulators are obtainable, "type J" with legs for switchboard mounting and "type J-2" contained in a case for portable use.

Battery-Charging Regulator for Industrial Trucks

To withstand the rough service usually given industrial trucks the Automatic Electrical Devices Company, 120 Opera Place, Cincinnati, Ohio, is prepared to supply the "Dreadnaught



SPRINGS ELIMINATE VIBRATION AND BOX PROTECTS METER FROM INJURY

chargometer," an instrument for automatically regulating the charging of storage batteries. It consists of a standard "chargometer," described in the ELECTRICAL WORLD of July 20, 1918, mounted upon springs and inclosed within a heavy steel box. This assembly may be mounted in any convenient location on all types and makes of industrial vehicles, since the spring suspension eliminates all danger of injury due to excessive vibrations and the steel cabinet protects the meter against mechanical damage.

Motor-Driven Flashers for Electric Sign

Simplified construction and reduction in the cost of installation have been aimed at in designing the "Travel-Flash" flashers recently placed on the market by the Alpha-Omega Electric Manufacturing Company, 241 Lafayette Street, New York City, for use with "talking" signs—that is, signs in which the letters of the words appear on the right of the sign and travel across to the left-hand side where they disappear.

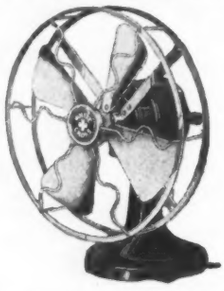
Only a minimum number of lamps are required when these flashers are used. The bulbs are placed at uniform distances on the sign, forming a universal lamp-letter field, consisting of horizontal rows of about 100 lamps. According to the size of the letters, there may be seven, nine or eleven of these rows. The bulbs in such signs are more intensely used than those in "talking" signs controlled by the customary flashers; for instance, in some styles of letters, the maker says, about 40 per cent of the bulbs are lighted by each word-flash.

In a lamp bank having 900 lamps there are 900 brushes, the average letter being formed by about twenty-one lamps. During the lapse of time necessary for ten letters to travel across the lamp bank or the face of the sign the number of make-and-break contacts is 210 multiplied by 100, or 21,000. The flashers, it is stated, make about 504,000 contacts a minute, and at five

hours a day the monthly total is more than 4,500,000,000 make-and-break contacts. This intensive performance of the flashers necessitates durable construction for satisfactory operation. According to the maker, this is obtained by a special method for taking care of the countless sparks produced by the multitude of making and breaking contacts.

A Combination Direct and Alternating-Current Fan

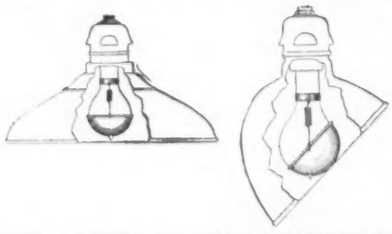
By adjusting a lever in the base of the 9-in. (23-cm.) desk and bracket fan which the Lindstrom, Smith Company, 1100 South Wabash Avenue, Chicago, will release to the trade early next month, it is possible to change the fan from a direct-current circuit and operate it on an alternating-current circuit or vice versa. This is because the fields have two separate field windings. Another special feature pointed out by the maker is a regulating switch which permits operating the fan at three different speeds. The fan, which is of the desk and wall type, can be obtained for voltages ranging from 12 to 220 volts, any cycle. It weighs 10 lb. (4.5 kg.) and is finished in black enamel and brass.



TWO SEPARATE FIELD WINDINGS

Porcelain - Enameled - Steel Glare Shields for Reflectors

Shields which serve as screens and protect the eye from the direct rays of lamps and prevent glare from reflectors which do not give requisite eye protection have recently been brought out by the Wheeler Reflector Company, 156 Pearl Street, Boston. They are made of porcelain-enameled steel and are held in position by coiled brass spring holders to cause them to fit snugly on the bulb of gas-filled lamps.



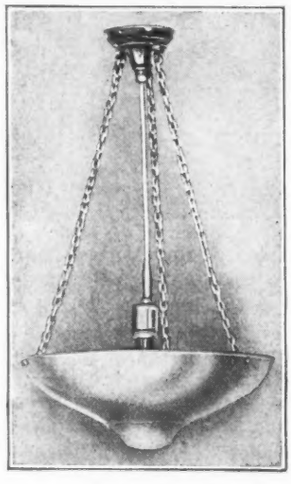
LEFT — SHIELD ON LAMP, STANDARD REFLECTOR; RIGHT — SHIELD IN ANGLE REFLECTOR

These shields may be attached to gas-filled lamps in any standard reflector. For use with standard angle reflectors an angle glare shield to fit gas-filled lamps is also procurable. This latter style is particularly adapted for use in protective lighting around industrial plants, in foundries, in tennis courts and in other places where angle reflectors are employed.

Shields may be had to fit 100-watt and 150-watt medium-base lamps, 200-watt medium-base lamps and 400-watt and 500-watt lamps with mogal bases.

Indirect-Lighting Fixtures for Gas-Filled Lamps

Indirect-lighting fixtures for gas-filled lamps have lately been placed on the market by the Wheeler Reflector Company, 156 Pearl Street, Boston, which consist of a chain-supported porcelain-enameled-steel dome-shaped reflector so positioned that when inverted below the lamp it gives a wide distribution of light against a white or slightly tinted ceiling and a soft diffusion by redirection over the area beneath it. The socket and lamp are suspended from a silk drop cord connected with the outlet, which is concealed in the ceiling canopy. The reflector is finished in white both inside and outside. These fixtures are made in three sizes—with medium-base socket for 100-watt and 150-watt lamps, with medium-base socket for 200-watt lamps, and with a mogul socket for 300, 400 and 500-watt sizes. The diameters of these fixtures are respectively 15, 18 and 20 in. (38, 46 and 51 cm.).



REFLECTOR IS OF PORCELAIN ENAMELED STEEL

Portable Utility Motor

An electric motor mounted on a portable stand and especially suited for driving small power machines in farms and country homes is being marketed by the Robbins & Myers Company, Springfield, Ohio. The outfit has a ¼-hp. motor furnished for operation on 32-volt lighting-plant circuits and for 110-volt, 60-cycle alternating-current circuits. A spiral-type back gear reduces the motor speed of 1150 r.p.m. to a speed of 285 r.p.m. at the pulley. The gears are fully inclosed and grease-packed.

A three-step pulley is supplied, having groove pulleys 4 in. (10 cm.) and 3⅛ in. (8 cm.) in diameter to take $\frac{5}{16}$-in. (8-mm.) round belts and a crown pulley of 2½-in. (6-cm.) diameter and 2-in. (5-cm.) face for flat belts.

The motor is mounted on an iron tripod base with rubber caps on the four feet and a handle on the motor top for carrying. A brass rod with a clamp for attachment to the driven machine is provided to maintain the proper belt tension. This rod is telescopic to take care of length adjustment, and the clamp can be turned at any angle.

Iron with Embedded Heating Wire

The heating wire or resistor of the Victory electric iron now being manufactured under the Wiegand patents by the Pittsburgh Electric Specialties Company, 396 Broadway, New York City, is completely incased in an insulating material which is said to be practically indestructible and to have a high heat conductivity. The wire is embedded under great hydraulic pressure, so that the base of the iron, the embedding material and the resistor form a compact solid mass which is then baked at high temperature, producing an extremely solid element that protects the resistor wire from destructive atmospheric influences.

Because of this construction all portions of the heating wire are in contact with a good heat conductor. Therefore the heat is conducted away from the wire into the base of the iron as fast as it is generated so that the temperature of the wire is maintained below the oxidation point. As the resistor is fixed rigidly in position, short or open circuits are prevented between the turns of the wire or other parts. The heating wire or resistor is said to be arranged for the most efficient heat distribution at the ironing surfaces. Only three minutes are required for the iron to reach proper temperature, this heat being retained for a long time.

RESISTOR HERMETICALLY SEALED IN INSULATING MATERIAL

The contact pin used to connect the

iron is removable, and the handle is roomy and comfortable. A tilt-up stand is provided so that the iron can be stood on end when not in use. Three voltages can be used with these irons, one type being made for 105-114 volts, another for 115-125 volts and the third for 32 volts.

Washer with Worm and Gear Drive

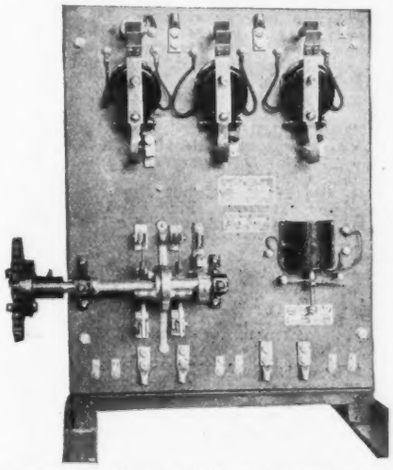
The electrically operated cylinder washing machine known as model 12 which the Automatic Electric Washer Company of Newton, Iowa, has just placed on the market utilizes a compact and quiet operating worm and gear drive. The carbonized steel worm runs with cast-bronze gear, bronze bushings and ball thrust bearings. A friction clutch between the motor and worm serves as a protective measure for the motor, which is operated by means of a toggle switch.

The cylinder of this washer rotates continuously in one direction, the drive being positive, simple and direct. The cylinder is constructed of wood and the tub is of galvanized iron. The machine is equipped with a ball-bearing swinging wringer which has 12-in. (30-cm.) rolls and locks in five different positions. The machine is equipped with a folding side bench for carrying extra tubs or a basket.

The "Nelson Automatic" model 14, also recently developed by this company, has the same washing and wringing mechanism as model 12, differing only in its transmission, which is a combination of flat belt and inclosed gears.

Semi-Magnet Controller for Elevator Installation

To be used on semi-magnet elevator installations a controller has recently been brought out by the Automatic Switch Company, 4 White Street, New

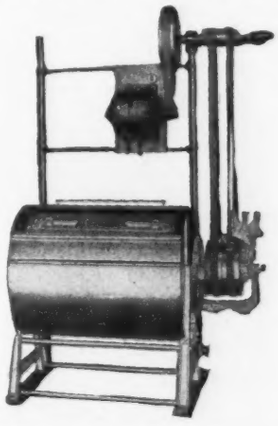


PREVENTS MOTOR FROM STARTING WHEN CURRENT RETURNS AFTER FAILING

York City. It includes, in addition to the controller proper, a type DV-30 reversing switch and a no-volt relay, the purpose of which is to prevent the starting of the motor when current returns after it has failed while the controller is in the "on" position. This controller can be used on motors up to and including 50 hp., the number of steps in the resistance varying from one to four according to the size of the motor.

Laundry Washer with Driving Mechanism

In order to save space and time in installing its Simplex laundry washing machine the American Ironing Machine Company, 168 North Michigan Avenue, Chicago, is equipping some of its machines with a self-contained countershaft and motor. As can be seen from the accompanying illustration, these are both supported on an iron framework, thereby saving the space which would be taken up by mounting the motor on the floor. Another advantage



PREVENTS MISALIGNMENT OF MOTOR

accruing from this arrangement is that the location of the washer may be easily changed without the bother of remounting the motor or altering the lengths of the belt. It eliminates possibility of misalignment of motor and pulley wheel and thus insures good operation.

Indoor Illuminating Sign with Changeable Front

A pencil or a match is the only tool necessary to form the legend on the face of the "Raco" sign manufactured

PLUGS ARE PUSHED OUT TO FORM SIGN

by Paul A. Raymond, 42 Coal and Iron Exchange, Buffalo, N. Y., for use in stores, banks, theaters and other places. It consists of a box serving as a reflector for the lamp bulb it contains and a card which fits into the open side of the box. This card contains many rows of small circular plugs previously cut out and then replaced in the holes. By pushing out these plugs a sign can be made showing words, characters, punctuation marks, figures, underlining, ornamental borders, etc. These can be made in different sizes since the entire card is filled with replaced perforations. By the use of ground and clear glass and colored-paper backings varied effects may be obtained.

These signs may be obtained in either flashing or steady-burning styles and are supplied with either single or double face. Cards have word fields of either 4 in. (10 cm.) by 13½ in. (34 cm.) or 4 in. (10 cm.) by 21 in. (53 cm.).

A 25-watt or 40-watt tubular tungsten lamp is used, and the reflecting surfaces are arranged for greatest efficiency. The exterior of the sign is finished in flat black, but special styles with other colored finishes and nickeled, brushed or polished brass metal frames as well as wood frames can be procured if they are desired.

Notes on Recent Appliances

Tapping Machine

Bench-type motor-driven tapping machines are being manufactured by the Bicknell-Thomas Company of Greenfield, Mass.

Portable Electric Drill

A ½-in. (1.3-cm.) portable electric drill with pistol grip and trigger is being marketed by the Black & Decker Manufacturing Company, 105-115 South Calvert Street, Baltimore, Md.

Coffee and Water Urn

Combination coffee and hot-water urns with capacities of 3 gal. to 10 gal. (11 l. to 37 l.) have been placed on the market by the Duparquet, Huot & Moneuse Company, 108 West Twenty-second Street, New York City.

Guy-Wire Pole Clamp

Clamps for attaching from one to six guy wires to poles are being sold by the Threadless Pipe Fitting Company of Newark, N. J.

Portable Electric Sewing Machine

The Standard Sewing Machine Company, Cleveland, Ohio, is selling a portable rotary-movement sewing machine equipped with a Hamilton-Beach electric motor.

Combination Valve Grinder and Drill

Combination portable electrically operated drills and valve grinders are a recent development of the Petterson Engineering & Manufacturing Company, Worcester, Mass.

Trade Notes

Westinghouse Changes

The following changes in the executive sales personnel of the Westinghouse Electric & Manufacturing Company are announced:

E. A. THORNWELL, manager of the railway and power division, Atlanta office, returned from government service, has resumed his former duties.

C. E. SMITH, of the engineering department, who spent several years in the Pittsburgh office and later was connected with the Robbins & Myers Company of Pittsburgh, has resumed work with the export department of the Westinghouse company.

A. D. STEPHANUS, after eight years in the export department, East Pittsburgh, Pa., has been transferred to the Westinghouse Norsk Elektrisk Aktieselskap, Christiania, Norway.

BIG SHIPMENT OF SEAMLESS TUBING IN APRIL.—The Wheeler Condenser & Engineering Company, Carteret, N. J., in the month of April manufactured and shipped 879,900 lb. of seamless drawn-brass and copper condenser tubes.

CINCINNATI COMPANY TO BE DISSOLVED.—The board of directors of the Incandescent Light & Stove Company, Cincinnati, Ohio, have called a meeting of the stockholders of that firm for May 27 for the purpose of ratifying a resolution for the dissolution of the company.

BARCELONA TO HAVE ELECTRICAL EXHIBITION.—Plans are being made for an international electrical and allied industrial exhibition at Barcelona, Spain, in 1921. The exhibition, according to the London *Electrical Review*, will be divided into thirteen sections, covering the whole field of constructive electricity. Before the war Germany supplied the greater part of the Spanish electrical imports.

"TRADING WITH THE FAR EAST," a companion volume to "Trading with Latin America," is a new title in the foreign trade series issued by the Irving National Bank, New York City. In acquainting the manufacturer or exporter with outstanding factors in trade beyond the Pacific, it provides an interpretation for commercial purposes of conditions in what promises to be one of our most exceptional markets for years to come.

GENERATING SETS TO BE SOLD.—The director of sales of the Surplus Property Division, War Department, will soon sell a number of generating sets bought originally for use in France but not shipped. The list is as follows: One Skinner-Westinghouse set, 12 in. by 12 in., left-hand, automatic, center-crank, high-speed, direct-connected to a 50 kw., three-wire, 125-150 volt Westinghouse direct-current generator, complete with field rheostat; two Erie-Ball sets, 10 in. by 10 in. (right and left) automatic 300-r.p.m. engines, direct-connected to 50-kw. General Electric direct-current, three-wire, 125-150-volt generators, complete with field rheostats and balancing coils. Bids for the sale of the above material will be opened May 28. Information can be obtained upon application to the office of director of storage, Munitions Building, Washington, D. C., or to the zone offices in the following cities: Boston, New York, Philadelphia, Newport News, Atlanta, Chicago, St. Louis, New Orleans, Omaha, El Paso and San Francisco.

HOOVER SWEEPER PLANS TO ENLARGE.—With plans under way to extend its trade into foreign countries and in order to erect a proposed new plant at Hamilton, Ontario, directors of the Hoover Suction Sweeper Company of North Canton, Ohio, have decided to increase the capital of the corporation from $1,000,000 to $2,000,000, their attorney, C. G. Herbruck, has announced. Preparations are being made by the Hoover company to build homes for its workmen which it will sell at cost. Thirty-five acres have been purchased in North Canton for this purpose. The homes will be built by a separate corporation, Mr. Herbruck said. In order to establish relations with British colonies and to obtain concessions for the introduction of Hoover sweepers into English possessions, Mr. Hoover will leave next week for England to confer with government officials. He also will visit France for the same purpose. The company recently took over the W. H. Hoover Company. The North Canton plant employs more than 700 persons and is working three eight-hour shifts. The population of North Canton is only 1300, and for this reason it has become necessary for the company to build new homes there.

THE EDISON STORAGE BATTERY COMPANY, Orange, N. J., announces that reduced prices for "A," "B" and "G" type Edison storage batteries made public March 1, 1919, are guaranteed until January 1, 1920.

THE CHELTEN ELECTRIC COMPANY, Philadelphia, announces the appointment of B. J. Aplin, 30 Church Street, New York City, as New York factory representative. Mr. Aplin was formerly with the New York Edison Company for a number of years.

THE R. B. COREY COMPANY, INC., announces the election of Charles L. Eidlitz as president of the company, succeeding the late R. B. Corey. Mr. Eidlitz, who is also president of the Metropolitan Electric Manufacturing Company of Brooklyn, N.

CHARLES L. EIDLITZ

Y., is well known in the electrical industry. The R. B. Corey Company is now carrying in its New York City warehouse complete stocks of conduits manufactured by the American Circular Loom Company, boxes and fittings manufactured by the Pratt Chuck Company, wires and cables manufactured by the Collyer Insulated Wire Company and expansive-screw anchors and bolts manufactured by the Ackerman-Johnson Company, in quantities sufficient, it is claimed, to meet any demand.

MAX LOWENTHAL announces that he has disposed of his interest in the Panama Lamp & Commercial Company and resigned as manager of its appliance department and will, beginning May 1, conduct an organization under the name of the Globe Commercial Company, with offices at 618 Mission Street, San Francisco. The new firm will represent the following factories and products: Tideman Electric Manufacturing Company, manufacturer of "Menominee" electrical products; "Pittsburgh" electric specialties; Russell "Hold Heat" appliances; "America" vacuum cleaners; "Haag" washing machines; "Domestic" electric steam washers; "Ostrander" sockets, shades, etc.; Standard "National" line of switches; "Empire" bell and toy transformers; "Wells" motor starting switches; "Globe" and "Waage" electric irons; "Red Top" toasters and iron plugs; automobile specialties, spotlights, timers, etc. Above representation does not include "Haag," "Domestic," "Ostrander" and "Standard" lines for California, Utah and Nevada.

THE VAN DORN & DUTTON COMPANY, Cleveland, Ohio, manufacturer of gears, has opened branch offices at New York and Chicago. At both cities it is the company's purpose to specialize in gears and pinions for electrical work. Harry F. Keegan, formerly with the Chicago surface lines, will manage the Chicago branch, with offices at 1241 First National Bank Building. His brother, John Keegan, will manage the New York end, with offices at Room 317, 30 Church Street.

THE TRIUMPH ELECTRIC COMPANY, Cincinnati, Ohio, announces the removal of its Pittsburgh office to larger quarters at 707-709 Ferguson Building, still in charge of Don D. Gill.

THE FRANK B. COOK COMPANY, Chicago, has obtained a license from A. F. Daum to manufacture refillable fuses under Daum patents. Negotiations are under way with other firms for a similar license.

L. V. ESTES, INC., industrial engineer and accountant, for a number of years in the McCormick Building, has removed its offices to the Century Building, 202 South State Street, Chicago, occupying the entire fifteenth floor.

THE GENERAL DEVICES & FITTINGS COMPANY has moved its offices from the Mid-City Bank Building to 441 South Desplaines Avenue, Chicago, thus consolidating its warehouse, manufacturing establishment and offices under one roof.

THE AMERICAN STEAM CONVEYOR CORPORATION, Chicago, announces the appointment of N. B. Stewart as district representative in charge of its St. Louis territory. Offices have been opened at 708 Merchants-Laclede Building, St. Louis.

A. P. ROYCE, formerly a lieutenant in the 108th Field Signal Battalion, U. S. A., has been appointed manager of the Detroit office of the Burke Electric Company. Before entering the army Mr. Royce was assistant sales manager of the Burke Company's office at Erie, Pa.

C. J. SKITTRALL, Dulwich Hill, Sydney, New South Wales, Australia, at present sales manager with Compton & Company, expects to engage in business as an electrical engineer and desires to represent American producers of motors, generators, transformers, cables, switchgear, fans, heating and cooking apparatus. Mr. Skittrall is experienced technically and practically in installation and managerial work.

THE PORTABLE ELECTRIC TOOL ASSOCIATION held its annual meeting in Cincinnati on April 24-25. In the discussions that ensued it was brought out that American manufacturers of portable electric tools would have to coöperate more closely to obtain a fair share of foreign business. Many requests for agency representations were reported, as were visits of European machinery importers with a view to making selling arrangements. That the outlook is good was the consensus of opinion.

F. W. ANDERSON, for six years in the Boston office of the Holtzer-Cabot Electric Company, will take up his new duties in New York about June 15 as sales engineer for this company. He will coöperate with Douglas Cairns in giving better and more extended service on motors under one horse power for labor-saving devices. Mr. Anderson was connected with the Westinghouse Electric & Manufacturing Company as a sales engineer on motors of the industrial type, joining the Holtzer-Cabot Company at Boston about 1913.

FIRST LIEUT. JOHN W. REED, of the Signal Corps, Engineering Research Division, Radio Development Section, Washington, will take up his new duties in June with the Holtzer-Cabot Electric Company, Roxbury, Boston. Mr. Reed will act as sales engineer and devote all his time to the specific application of fractional horsepower motors to various labor-saving devices. Mr. Reed has been with the Cutler-Hammer Manufacturing Company and with the Diehl Manufacturing Company of Elizabeth, N. J., where he broadened his experience in motors under 1 hp. in rating.

J. P. ALEXANDER, until recently resident agent for the General Electric Company at Trenton, N. J., has been transferred to the power and mining department of the office of the company in New York City. For five years previous to Sept. 1, 1910, when he joined the engineering staff of the General Electric Company at Pittsfield, Mass., Mr. Alexander was purchasing agent for the Wheeling (W. Va.) Traction Company. In 1912 he was transferred from the Pittsfield office of the General Electric Company to New York, and later was stationed in Trenton, where he established the office of resident agent in 1914. Mr. Alexander has been closely identified with the engineering development of the pottery industries of that section.

THE FORD MICA COMPANY, INC., has moved its factory and offices to 14 Christopher Street, New York City.

THE TERRY STEAM TURBINE COMPANY, Hartford, Conn., announces the appointment of R. L. Thomsen as sales manager.

THE STANDARD ELECTRIC TOOL COMPANY of Cincinnati, Ohio, is reported to have completed the removal of its machinery to the new plant at York Street and Western Avenue.

THE WHITE LILY MANUFACTURING COMPANY, of which Sam T. White is president, has announced that it will spend $150,000 in erecting an addition to its washing machine factory at Davenport, Ia.

THE MARLIN-ROCKWELL CORPORATION, manufacturer of automobile accessories, is concentrating its plant at New Haven, Conn., and is also going to manufacture incandescent lamps, it is reported.

THE APPLIANCE MANUFACTURING & DISTRIBUTING COMPANY of Logansport, Ind., it is reported, is planning to remove to Peru, Ind., following an agreement made with the Peru Chamber of Commerce.

JOSEPH MYERSON, dealer in steam, electrical and power transmission machinery, announces that he has moved to large and more centrally located quarters at 411-413 Atlantic Avenue and 74 Purchase Street, Boston.

ALFRED N. PREMO, formerly with the New Engineering Company, Waterbury, Conn., has been appointed assistant manager of the Hartford (Conn.) Electrical Supply Company, one of the largest jobbers in the Hartford district.

M. G. CARHART and GEORGE B. CROSS, formerly with the Industrial Electrial Furnace Company, are now associated in the sale of the Detroit Electric Furnace Company's equipment, carrying the firm name of Carhart & Cross, 1401 Monadnock Block, Chicago.

H. B. BUSH of the Bush Electric Tool & Manufacturing Works, Redlands, Cal., writes that he is shipping his entire equipment to Cleveland, Ohio, where he is forming a new company to be known as the Bush Electric Manufacturing Company. A rapidly growing volume of sales made it necessary to have large factory space in the East. The company's temporary address is 6616 Morgan Avenue, Cleveland, Ohio.

THE VAN DORN & DUTTON COMPANY, Cleveland, Ohio, manufacturer of gears, has opened branch offices at New York and Chicago. At both cities it is the company's purpose to specialize in gears and pinions for electrical work. Harry F. Keegan, formerly with the Chicago Surface Lines, will manage the Chicago branch with offices at 1241 First National Bank Building. His brother, John Keegan, will manage in New York, with offices at Room 317, 30 Church Street. The latter comes from the Interborough Rapid Transit Company, New York.

MEYER, STRONG & JONES, INC., have succeeded to the engineering practice of Henry C. Meyer, Jr., and Bassett Jones, associated, and of William E. S. Strong. Mr. Strong was connected for many years with the American Radiator Company as chief engineer, and represented the Bankers' Trust Company, the Guaranty Trust Company and J. P. Morgan & Company in the construction of the buildings they now occupy. He was also connected with the export department of J. P. Morgan & Company and during the past year has been engaged in war work with MacArthur Bros. & Company, in connection with the United States Bag Loading Plant No. 2 at Woodbury, N. J. Mr. Meyer and Mr. Jones have been engaged in consulting work in New York City since 1903 and have been responsible for the mechanical, electrical and power equipments of many buildings and industrial plants, including the United States Military Academy at West Point, the Chelsea Piers in New York City, the Bloomfield Works of the General Electric Company, the Equitable, Bankers' Trust, Guaranty Trust and Morgan Buildings, and the naval operating base at Hampton Roads. Messrs. C. A. King, H. E. Meeker, H. F. Richardson and J. J. Ruckes, who have been associated with Messrs. Meyer and Jones for a number of years, will be in responsible charge of the work in the new organization. The new firm will act as consulting engineers for steam and electrical work, power plants, etc., and will have offices at 101 Park Avenue, New York.

Trade Publications

TABLE STOVE.—A folder about its electric table stove has been prepared by the Standard Stamping Company, Huntington, West Va.

PORTABLE CONVEYOR.—The Portable Machinery Company of Passaic, N. J., is circulating an illustrated folder that tells about the Scoop portable conveyor and its uses.

GRINDERS.—The Stow portable electric grinder and tool-post grinder are illustrated and cataloged in a leaflet prepared by the Stow Manufacturing Company of Binghamton, N. Y.

SOLDERLESS TERMINALS.—An illustrated folder about Meliorate solderless terminals is being distributed by the Standard Scientific Company, 70 Fifth Avenue, New York City.

INDUCTION REGULATORS.—Induction regulators, types J and J-2, are the subject of circular No. 31, which the States Company of 72 Francis Avenue, Hartford, Conn., has issued.

TACHOMETER.—The Van Sicklen-Elgin chronometric precision tachometer is completely explained in bulletin No. 81 from the Central Scientific Company, 460 East Ohio Street, Chicago.

LIGHTING FIXTURES.—"Eleco" adjustable lighting fixtures (Raymo patent) are the subject of a folder which the Elliott-Lewis Electrical Company of 1017 Race Street, Philadelphia, is distributing.

LIGHTING FIXTURES.—The Wheeler Reflector Company of 156 Pearl Street, Boston, tells about its new "1300" line of fixtures for lighting railroad properties with multiple "mazda C" lamps in schedule FB.

MINE-LAMP CHARGER.—The Edison electric safety mine-lamp charging equipment manufactured by the Mine Safety Appliances Company, 539 Fourth Avenue, Pittsburgh, Pa., is described in a leaflet of recent issuance.

MINE-LAMP HEADPIECE RACK.—The Mine Safety Appliances Company, Chamber of Commerce Building, Pittsburgh, Pa., has issued a leaflet telling about its Edison electric safety mine-lamp headpiece rack equipment.

SAFETY MINE LAMP.—The Edison electric safety mine lamp is the subject of bulletin 300 issued by the Edison Storage Battery Company, Orange, N. J., and the Mine Safety Appliances Company, 539 Fourth Avenue, Pittsburgh, Pa.

WASHING MACHINES.—"Seven Million Dollars Untouched" is the title of an interesting booklet issued by the Blue Bird Appliance Company, St. Louis, in which the possibilities of electric appliance sales are discussed for the electrical dealer.

STREET-LIGHTING FIXTURES.—Series Mazda street-lighting fixtures with porcelain receptacle heads and hooded or unhooded reflectors are described and illustrated in bulletin F of the Wheeler Reflector Company, 156 Pearl Street, Boston.

LIGHTING FIXTURES. — Industrial lighting and production are discussed in a booklet issued by the Henkel & Best Company, 122 South Michigan Avenue, Chicago, to describe its heavy-duty reflectors, "Factrylites" and shade-holder reflectors.

ICELESS REFRIGERATOR.—The "Frigidaire," a self-contained, automatically operated iceless refrigerator, is described and illustrated in an advertising folder got out by the Frigidaire Corporation of Detroit, Mich., and 1760 Broadway, New York City.

WASHING MACHINE.—"The Blue Bird Book" is the title of an exceptionally handsome booklet of twenty-one pages printed in colors and giving the features and advantages of the washing machine made by the Blue Bird Appliance Company, St. Louis, Mo.

ALTERNATING-CURRENT INSTRUMENTS.—The Pyroelectric Instrument Company, 636 State Street, Trenton, N. J., has issued circular No. 161 on alternating-current instruments and accessories, describing and listing the following pieces of apparatus: Northrup alternating-current galvanometer, a static swinging coil electro dynamometer, Compton quadrant electrometer, dry-cell potential sets, quartz fibers variable standards of self and mutual inductance, standards of self-inductance, lamp and scale reflection indicator and telescope and scale.

ENTRANCE SWITCH.—The Trumbull Electric Manufacturing Company of Plainville, Conn., catalogs its new externally operated entrance switch No. 5741 in circular No. 43.

ELECTRIC RANGES.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., announces a new range part catalog covering type 3-19-B automatic electric ranges.

PULLEYS.—Pulleys, hangers, pillow blocks, arbor presses, reducing gears and revolving display tables are cataloged in a booklet issued by Winfield H. Smith, 10 Lock Street, Buffalo, N. Y.

FLOOR MACHINE.—The "Utility" floor machine for scrubbing, waxing, polishing and refinishing floors is told of in a circular which the Kent Vacuum Cleaner Company, Rome, N. Y., has recently printed and distributed.

PYROMETER.—The Northrup continuously deflecting pyrovolter, a pyrometer containing circuits for checking its indicators, is described in circular No. 15, which has been printed by the Pyroelectric Instrument Company, 636 East State Street, Trenton, N. J.

New Incorporations

THE RED SPOT BATTERY COMPANY of Nashville, Tenn., has been chartered with a capital stock of $5,000 by F. W. Gilbert, T. E. Gilbert, R. S. Pide, H. A. Robertson and DeWitt Chappell.

THE LAKE ERIE LIGHT & POWER COMPANY of Geneva-on-the Lake, Ohio, has been incorporated with a capital stock of $10,000 by G. H. Swan, J. Y. Hall, L. C. Spencer, Sidney Ramsey and H. B. Gregory.

THE WESTFIELD (N. J.) STORAGE & BATTERY COMPANY has been incorporated with a capital stock of $5,000 by Leo N. Berse of Plainfield, David Berse of Plainfield and Martin H. Cohen of New York City.

THE AMERICAN ELECTRIC FUSION COMPANY of Warren, Ohio, has been incorporated by A. R. Ackerman, Thomas F. Turner, Wendell Herbruck, H. W. Webber and G. Kellogg. The company is capitalized at $25,999.

THE CONTRA-POLE ELECTRIC COMPANY of Brooklyn, N. Y., has been incorporated by S. Mandell, S. T. Siegel and M. Greenberg. The company is capitalized at $100,000 and proposes to manufacture electrical apparatus.

THE GORDON ELECTRIC MANUFACTURING COMPANY of Waterbury, Conn., has been incorporated by Ira A. Seltzer, A. J. Smith and N. A. Neill. The company is capitalized at $75,000 and proposes to manufacture electrical devices of various kinds.

THE ROBERT PHILLIPS COMPANY of New York, N. Y., has been incorporated with a capital stock of $125,000 to manufacture electric and gas fixtures. The incorporators are H. E. Cook, J. and Robert Phillips, 101 Park Avenue, New York City.

THE ARTCRAFT CLOCK COMPANY of New York, N. Y., has been incorporated by Aaron Frankenburg, Max Teicher and H. Eliot Reid, 137 Joralemon Street, Brooklyn. The company is capitalized at $10,000 and proposes to manufacture clocks, electrical novelties, etc.

THE BEECH BOTTOM POWER CORPORATION of Wheeling, W. Va., has been incorporated by Allen E. Moore, George F. Jebbett and Alfred F. McCabe. The company is capitalized at $400,000 and proposes to construct and operate an electric power plant.

THE CUBA (N. Y.) ELECTRIC COMPANY has been incorporated with a capital stock of $50,000 to generate and distribute electricity for lamps, heaters and motors. The incorporators are Robert H. Bartlett, Harry E. Keller and George M. Bartholomew of Cuba.

New England States

MANCHESTER, N. H.—Plans are under consideration by the Amoskeag Company, it is reported, for installing turbine wheels at the head of the lower canal and at the old paper mill of the P. C. Cheney Company on the west side of the Merrimac River, a short distance below Amoskeag Falls. Nothing definite has been decided upon.

AMSDEN, VT.—The Amsden Lime Company is reported to be contemplating equipping its lime quarries for electrical operation. Amsden has not a post office.

BROOKLINE, MASS.—The installation of an ornamental lighting system on Harvard Street, from Stearns Road to Babcock Street, and on Beacon Street, from Winchester Street to St. Paul Street, is under consideration by the Board of Selectmen.

HAMDEN, CONN.—The Yale Tire & Rubber Company, recently organized, is planning to erect a factory and power house on Dixwell Avenue in Hamden. J. E. Hubinger, 827 Main Street, New Haven, is president of the company.

PAWTUCKET, R. I.—Plans are under consideration by the Chamber of Commerce to secure a better lighting system for the center of the city.

Middle Atlantic States

BELMONT, N. Y.—Bonds to the amount of $10,000 have been voted to establish a municipal electric light plant in Belmont.

BROOKLYN, N. Y.—Plans have been filed by the Robins Dry Dock & Repair Company, 29 Beard Street, for alterations and improvements to its engine plants on Beard Street, near Otsego Street.

BUFFALO, N. Y.—Preliminary plans are being prepared by the Board of Supervisors of Erie County for the erection of a new penitentiary building to be located at Wende. The plans provide for a power house, refrigerating plant, dormitories, laundry and other structures. The cost of the project is estimated at about $1,000,000. Alonzo G. Hinckley, 29 City Hall, is clerk.

CENTRAL ISLIP, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until June 4 for construction of additional quarters for acute cases, including heating, sanitary and electric work, at the Central Islip Hospital, to cost about $150,000. L. P. Pilcher, Capitol, Albany, is state architect.

NIAGARA FALLS, N. Y.—Contract has been awarded by the Niagara Falls Power Company to the Read-Coddington Company, Portage Road, Niagara Falls, for the construction of an addition to its plant. The building will be about 65 ft. by 238 ft. and will cost about $160,000.

OSSINING, N. Y.—Bids will be received by Charles F. Rattigan, superintendent of state prisons, Room 618, Hall of Records Building, Centre and Chambers Streets, New York City, until June 17 for construction of mess hall and kitchen building (No. 4); detention building (No. 5); outside cell building (No. 7); clinic building (No. 8), including heating, sanitary and electric work; also for pump house and reservoir and two new 400-hp. water-tube boilers. Drawings and specifications may be consulted at the office of the warden of the above institution; at Room 618, Hall of Records, New York City, and at the Department of Architecture, Capitol, Albany. L. F. Pilcher is state architect.

ROME, N. Y.—Arrangements have been completed by the Rome Gas, Electric Light & Power Company for the purchase of property, consisting of about 11 acres of land, near Rome, to be used as a site for the erection of a new electric and gas plant. The company has been granted permission by the Public Service Commission to issue $245,164 in bonds for the construction of the proposed plant.

SYRACUSE, N. Y.—The Ward Brothers Company has purchased a site on Taylor, Burt, South, State and Grape Streets, on which it proposes to erect a baking plant, to cost about $250,000. E. J. Moore is local manager.

HOBOKEN, N. J.—Plans are being considered by the Navy Department, Washington, D. C., for the installation of an electric power plant to furnish electrical service for the operation of mechanical equipment and lighting, etc., of the three piers taken over by the United States government, heretofore owned by the Hamburg-American Line. Electricity has formerly been furnished by a private company. The cost of the proposed improvements is estimated at $2,500,000.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

JOHNSTON, PA.—Plans have been prepared by the board of directors of the Memorial Hospital for the construction of a two-story boiler plant and laundry at the nstitution. The building will be about 45 't. by 70 ft. and will cost with equipment about $50,000.

KINGSTON, PA.—Plans have been completed by the Kingston Coal Company for the installation of a quintuple electrically operated pumping unit, having a capacity of 3,000,000 gal. per day from a depth of 700 ft. Power will be furnished by a 500-hp. turbine. Contract has been awarded for machinery.

PITTSBURGH, PA.—The Duquesne Light Company is contemplating the erection of a condenser building and switching plant at Woodville, to cost about $10,000.

PITTSBURGH, PA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 16 for furniture, lighting fixtures, etc., for the United States post office and court house at Pittsburgh, Pa. For details see Searchlight Section.

WAYNESBORO, PA.—Preliminary work has been started by the Waynesboro Electric Company for the erection of a high-tension transmission system from the present terminus at Blue Ridge Summit to Greenstone via the Monterey and Charmain districts, a distance of 2 miles. The proposed line will furnish energy for stone-crushing operations and other industrial plants.

BALTIMORE, MD.—Bids will be received at the office of the city registrar, City Hall, Baltimore, Md., until June 11 for furnishing and erecting one 25-kw. and one 15-kw. turbo-generator set and switchboard for the Mount Royal pumping station. Specifications may be obtained at the office of Walter Lee, water engineer, City Hall, after May 23. A deposit of $5 will be required for each set of specifications.

SPENCER, W. VA.—The installation of a municipal electric light plant is under consideration by the City Council.

WELCH, W. VA.—The Welch Armature Company, it is reported, is contemplating the construction of a new plant. The company recently increased its caiptal stock from $5,000 to $25,000.

WHEELING, W. VA.—Bids will be received until May 31, by S. G. Smith, receiver of the Benwood-McMechen Consolidated Water Company, for two motor-driven centrifugal pumps. Specifications, etc., may be obtained upon application to Leo Hudson, engineer, 8001 House Building, Pittsburgh, Pa.

CHARLOTTESVILLE, VA.—The plant of the Briggs Electrical Company was recently destroyed by fire, causing a loss of about $12,000.

WASHINGTON, D. C.—The Public Utilities Commission has authorized the Potomac Electric Power Company to issue $1,750,000 for extensions and general improvement work.

North Central States

DETROIT, MICH.—The Stecker Electric & Machine Company is contemplating the construction of a new factory building.

KINDE, MICH.—The Council has awarded a contract to the Electric Supply Company, 107 South Water Street, Saginaw, for the installation of an electric lighting system in Kinde, at $10,000.

SAGINAW, MICH.—The Saginaw Malleable Company is planning to double the output of its plant. One addition is under construction and two more units will be built, at a cost of about $275,000. The company is a subsidiary of the General Motors Company.

BELLEVUE, OHIO.—Bids will be received at the office of the director of public service, Bellevue, until June 5 for construction of reservoir, low service pumping station and furnishing and installing two gas-engine-driven centrifugal pumping units, each having a capacity of 5000 gal. per minute. William G. Clark, Spitzer Building, Toledo, is consulting engineer.

HAMILTON, OHIO.—Work, it is understood, will soon begin on the construction of the power plant in connection with the tractor plant of Henry Ford & Son at Hamilton.

OBERLIN, OHIO.—An election will be held May 27 to submit to the voters the proposal to issue $50,000 to establish a municipal electric light and power plant in Oberlin.

PIQUA, OHIO.—Plans, it is reported, are being prepared by the J. J. Wernette Engineering Company for a 1000-hp. power plant for the Orr Felt & Blanket Company in Piqua.

PIQUA, OHIO.—The J. J. Wernette Engineering Company, it is understood, is preparing plans for an addition to the power house of the French Oil Machinery Company in Piqua.

PORT CLINTON, OHIO—The City Council has awarded the Port Clinton Electric Light & Power Company a contract to supply electricity to maintain the new lighting units to be installed in the lake front section.

PAINTSVILLE, KY.—The Wells-Elkhorn Coal Company, recently incorporated, is planning to install three power plants and to equip three mines with motor-driven machinery. The company would like to receive proposals from manufacturers and dealers in equipment and machinery for electrical and steam plants and mining machinery. Further information may be obtained from C. O. Messenger, general manager, Paintsville.

PIERCETON, IND.—The Pierceton Light & Water Company has petitioned the Public Service Commission for permission to issue $35,000 in capital stock, the proceeds to be used for to make improvements, etc.

CHICAGO, ILL.—The question of equipping the Illinois Central Railroad lines within the city limts for electrical operation is under consideration by the City Council. Plans for carrying out the project will be submitted to the Council by the railroad and city engineers.

DECATUR, ILL.—The Decatur Railway & Light Company has purchased a site on Wood Street, on which it will erect new barns and city shops.

DELAVAN, ILL.—The Royal Light & Power Company is contemplating the erection of an electric transmission line from Delavan to San José.

QUINCY, ILL.—The Quincy Railway Company has entered into a contract with the Mississippi River Power Company to supply energy for its system.

GREEN BAY, WIS.—The Green Bay Drydock Company is being organized by local business men headed by Carl Hartmann. The company will be capitalized at $500,000 and proposes to construct a new floating drydock, 630 ft. long. It will be built in four sections and will be equipped with electrically operated machinery.

PORT WASHINGTON, WIS.—The Council is considering an issue of $30,000 in bonds for extensions to the municipal electric light and power plant, including the installation of an additional steam generating equipment.

DULUTH, MINN.—The Great Northern Power Company is installing a 15,000-hp. generating unit at its plant, increasing the total output to 75,000 hp.

RED WING, MINN.—Bonds to the amount of $350,000 have been voted for the construction of a municipal electric light plant.

STACYVILLE, IOWA.—J. A. Weber, it is reported, is contemplating the construction of a dam and power plant in Stacyville. The Power Engineering Company, Corn Exchange Building, Minneapolis, is engineer.

WAPELLO, IOWA.—Bids will be received by the Muscatine-Louisa Drainage District No. 13, at the office of the county auditor of Louisa County, Wapello, until June 10, for a steam-driven pumping plant, containing one 36-in. and one 24-in. suction centrifugal pump, and for building to house the plant. The Elliott & Harman Engineering Company of Peoria, Ill., has charge of the engineering work.

ST. LOUIS, MO.—Plans are being prepared by the Manufacturers' Railway, 2925 South Broadway, St. Louis, for changing its switching system from steam to electricity. The work consists of the installation of poles, trolleys, transformers and the erection of 24 miles of transmission line.

EMERSON, NEB.—An election will be held on May 28 to submit to the voters the proposal to issue $20,000 in bonds for the installation of a municipal electric light plant.

PLYMOUTH, NEB.—Arrangements are being made by local business men for the erection of an electric transmission line from Plymouth to Beatrice to secure electricity for the town, which has been without electrical service for a number of years. Harry Gerhardt of Plymouth is interested in the project.

WEST POINT, NEB.—Plans are under consideration for the construction of a hydroelectric plant on the Elkhorn River, 3 miles from West Point, to supply electricity here.

CLAYTON, KAN.—Bonds to the amount of $10,000 have been voted for the erection of an electric transmission line from Clayton to Norcatur to supply electricity here.

TOPEKA, KAN.—Contracts, it is reported, will be awarded by the State House committee on May 27 for improvements to the State House light and heating plant. Further information may be obtained of the secretary of the building committee.

Southern States

BENSON, N. C.—Contract has been awarded by the city of Benson to Tucker & Laxton of Charlotte for the construction of an electric light plant. The plans call for the development of 200 hp., to cost about $40,000. Gilbert C. White of Durham is engineer.

HICKORY, N. C.—The Hickory Electric Company is planning to erect an exchange building in Hickory. A. A. Shufford, Jr., is manager.

NASHVILLE, N. C.—Bids will be received until June 2 by the Board of Commissioners of Nash County for construction and improvement, lighting and heating of the Nash County courthouse. J. B. Boddie is clerk of board.

CORNELIA, GA.—The Wofford Shoals Light & Power Company is considering enlarging its plant and extending its transmission lines to nearby towns.

FORT GAINES, GA.—The Georgia-Alabama Power Company, it is reported, has purchased property, including several acres of land on Pataula Creek, and contemplates a hydroelectric development involving an expenditure of about $200,000. Electricity generated at the proposed plant will be transmitted to Fort Gaines, Ga., Eufaula, Fla., and probably other cities. Dermott Shemwell of Lexington, N. C., is president.

SARASOTA, FLA.—Bids will be received by the city of Sarasota at the office of the city clerk until June 9 for furnishing and installing three internal combustion engines, fuel oil as motive power, two of 150 hp. and one of 100 hp., directly connected to generators and exciters. Air to be furnished in accordance with underwriters' specifications; two compressors, complete circulating system, switchboard, two three-stage rotary pumps, with 25 ft. suction and against a 350 ft. head, to have a capacity of 500 gal. per minute each. Motors 75 hp., 220 volts, three-phase, 60 cycle, slip ring type, all on one C. I. base. Wilbur A. Ginn is engineer in charge.

KINGSPORT, TENN.—The Holston River Power Company, recently organized, contemplates the construction of dams on Holston River in Sullivan County, above Kingsport, and on Watauga River in Washington County. Dam sites have been secured 3 to 10 miles from Kingsport, and 10 to 20 miles from Johnson City and Bristol. The plans provide for a development of 100,000 hp. Electricity generated at the proposed plant will be transmitted to Kingsport, Johnson City, Bristol and other nearby cities in Tennessee and Virginia. The cost of the project is estimated at $5,000,000. James B. Cox of Johnson City is president, and F. M. Butler of Orbisonia, Pa., is engineer.

MEMPHIS, TENN.—Bids will be received at the office of the district engineer, Mississippi River, Memphis, Tenn., until June 20 for furnishing three water-tube boilers for U. S. dredge Pappa. Further information may be obtained on application to district engineer, P. O. Box 1017, Memphis.

SNEEDVILLE, TENN.—Plans are under consideration for the construction of a hydroelectric plant on Clinch River at the Auger in Hancock County, to develop about 4000 hp. Electricity generated at the plant will be used to operate a proposed electric railway. The transmission system will extend from Morristown to Moorsburg, Treadway, Sneedville and Kyle Ford. The cost is estimated at $1,500,000. John N. Adams, chemical engineer, Charleston, Tenn., is interested in the project.

BELZONI, MISS.—Either a 150-hp. boiler or a 75 to 100-hp. crude-oil engine will be installed in the municipal electric light plant within the next 60 days. J. J. Sisloff is superintendent.

TAHLEQUA, OKLA.—Estimates of the cost of a dam on the Illinois River to supply power for the proposed municipal electric light plant will be submitted to the Council in the near future. It is estimated that 1000 hp. could be developed. Investigations are being made by Prof. Gladstone of the Arkansas University.

CAMP TRAVIS, TEX.—Bids will be received at the office of the constructing quartermaster, Mexican Border Project, Camp Travis, until June 2, for construction of approximately 997 adobe and brick buildings, water and sewer lines, wiring, etc., at approximately 30 posts and camps along the Mexican border in Texas, New Mexico and Arizona. Plans, specifications, etc., may be obtained upon deposit of $50.

BRIDGEPORT, TEX.—Steps, it is reported, have been taken by Harry Hardy to organize a company to construct and operate an electric light plant and ice factory in Bridgeport.

GONZALES, TEX.—The Gonzales Water Power Company is contemplating installing additional machinery at its hydroelectric power plant, to cost about $80,000.

GROVETON, TEX.—The property of the Groveton Light & Ice Company has been purchased by Hayne Nelms and associates. New machinery, it is understood, will be installed.

STEPHENVILLE, TEX.—The Texas Power & Light Company of Dallas has purchased the local electric light and transmission system at Stephenville. The company plans to extend its transmission system from Brownwood plant to Stephenville. Improvements, including the installation of additional machinery, will be made.

Pacific and Mountain States

SEATTLE, WASH.—Work has started on the construction of the first two pontoons of an 18,000-ton drydock at the shipyard of the Ames Shipbuilding & Drydock Company. Six pontoons will be built, each having a lifting capacity of 3000 tons each. Electrically driven pumping equipment will be installed. T. A. D. Jones is general manager.

SEATTLE, WASH.—The Western Coke & Collieries Company has engaged Herbert C. Moss of the Standard Electric Company of Seattle as consulting engineer in connection with developing large coal areas near Snoqualmie. The company contemplates the installation of an electric locomotive and hauling system, an aero tramway, compressor fans and other coal-mine equipment.

SEATTLE, WASH.—The City Council has appropriated $20,000 for the further drilling operations at George Creek in connection with investigations of the Skagit power project.

WENATCHEE, WASH.—The Okanogan Valley Power Company will soon begin work on construction of a dam and power plant on the Similkameen River, a short distance below its present power house. The new plant will have a generating capacity of 5000 hp.

KLAMATH FALLS, ORE.—The plant of the Big Lakes Box Company has been closed for repairs and improvements. An addition will be erected and electrically operated machinery installed. A sawdust and shavings burner system, to cost $10,000, will be installed.

MARSHFIELD, ORE.—The Mountain States Power Company is planning to rebuild the Dutch ovens under the power plant boilers at Smith Mill. A. L. Martin is manager.

CALEXICO, CAL.—An election will be held May 27 to vote on the proposal to issue $160,000 for a municipal electric plant and $165,000 for a municipal gas plant.

COVINA, CAL.—The board of directors of the Covina Citrus Association has authorized an expenditure of $140,000 for the erection of a new precooling plant and packing works. Considerable electrical and mechanical equipment, including fans and blowers, industrial motors, refrigerating and ice-making apparatus, conveying and hoisting machinery and other appliances, will be installed. W. W. Bennett is manager.

FRESNO, CAL.—Arrangements, it is understood, are being made by Umbsen, Kerner & Eisert of San Francisco, for the construction of a large reservoir and dam on Chowchilla River, near Fresno, to be used for irrigation purposes. The cost of the project is estimated at about $300,000. O. L. Markley is local representative of the company.

FRESNO, CAL.—Plans are being prepared by the San Joaquin Light & Power Company for the erection of a new substation and shops at a location on the west side of the Southern Pacific tracks, extending from Divisadero to Belmont Street. The present substation at Fresno and N Streets will be abandoned.

LOS ANGELES, CAL.—Bids, it is reported, are being asked by the Keystone Iron Works, Merchant National Bank Building, Los Angeles, for the construction of its new plant on Santa Fé Avenue, consisting of foundry, office building and a warehouse and service. The foundry will be equipped with furnaces and three electrically operated cranes.

LOS ANGELES, CAL.—An agreement has been reached between the City Council and the Southern California Edison Company whereby the latter has agreed to sell its electric distributing system to the city for $11,000,000. The proposed purchase contract will be submitted to the voters at the general election to be held on June 3. Under the terms of the contract it is provided that the company shall have the option to purchase, at rates fixed by the Railroad Commission, all surplus power generated by the city for a period of fifteen years.

OAKDALE, CAL.—The Sierra & San Francisco Power Company is considering plans for the construction of new reservoirs, which will more than double its storage capacity, part of which will be used for irrigation purposes. H. F. Jackson, 58 Sutter Street, San Francisco, is general manager.

PORTERSVILLE, CAL.—Plans are under consideration by the City Council for the establishment of a municipal electric light plant.

MACKAY, IDAHO.—The Public Utilities Commission has granted the Mackay Light & Power Company a certificate of convenience and necessity to furnish electricity for the entire Lost River Valley. The company will extend its service to the towns of Arco, Moore, Leslie and other places in the valley. The cost is estimated at about $50,000.

PHOENIX, ARIZ.—A company is being organized by the Phoenix Wholesale Meat & Produce Company, Fifteenth Avenue and River Street, and the Tribolet Packing Company of Bisbee, for the purpose of erecting a packing plant in Phoenix, to include a refrigerating and ice-manufacturing plant.

RED LODGE, MONT.—The Northwestern Improvement Company is contemplating the installation of a generating unit and condenser at its power plant, increasing the output by about 300 hp.

Canada

NANAIMO, ONT.—The Nanaimo Electric Light, Power & Heating Company has applied to the Minister of Lands for permission to divert, store and distribute water from the Millstone River. William Lewis is secretary.

WALKERVILLE, ONT.—General contract for the construction of the new plant for the General Motors Corporation, 88 East Congress Street, Detroit, Mich., at Walkerville, has been awarded to W. E. Wood & Company of Canada, 103 Sandwich Street, Windsor, Ont. The cost of the plant is estimated at $6,000,000.

MONTREAL, QUE.—Arrangements are being made for equipping the railway system of the Montreal harbor for electrical operation.

Miscellaneous

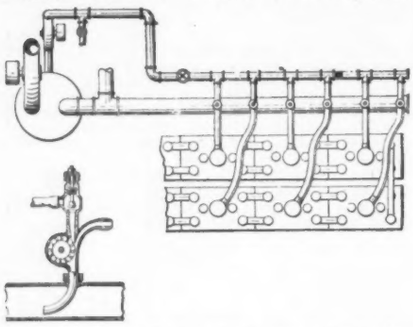
PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until May 31 for boiler tubes, copper wire, steel rope, cable clips, bronze springs, gasoline tractor and trailers, battery cells, oilers, etc. Blanks and information relating to this circular (1278) may be obtained at the above office, and at the office of the assistant purchasing agents, 24 State Street, New York City; 606 Common Street, New Orleans, La., and Fort Mason, San Francisco, Cal.

CAVITE, P. I.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 26 for furnishing and installing equipment for power plant at the local naval station. The cost is estimated at $90,000. Specification 3871.

(Issued May 6, 1919)

1,293,100. AUTOMOBILE; Merion J. Huggins, New York, N. Y. App. filed March 27, 1916. Electric speed-controlling mechanism.

1,293,314. STARTING AND LIGHTING SYSTEM FOR AUTOMOBILES; William L. Bliss, Niagara Falls, N. Y. App. filed May 13, 1914. Generator effective at low speeds.



1,302,648—Ventilation of Storage Batteries

1,293,573. MOUNTING FOR ELECTRIC GENERATORS; Ira T. Swartz, Indianapolis, Ind. App. filed Oct. 22, 1917. Self-centering.

1,293,646. POWER-TRANSMISSION MECHANISM; Cyrus B. Kurtz, Lakewood, Ohio. App. filed May 22, 1915. Two electric units in combination with differential mechanism between the engine and the driven shaft.

1,302,603. SECONDARY CLOCK; Alfred L. Sohm, Chicago, Ill. App. filed May 21, 1917. Step-by-step mechanism.

1,302,604. SECONDARY-CLOCK SYSTEM; Alfred L. Sohm, Chicago, Ill. App. filed May 21, 1917. Proof against double or false impulses.

1,302,605. SECONDARY CLOCK; Alfred L. Sohm, Chicago, Ill. App. filed May 21, 1917.

1,302,616. AUTOMATIC TABULATING MACHINE; Robert N. Williams, London, Eng. App. filed May, 1915. Adding mechanism is operated by perforated cards.

1,302,618. WARNING SIGNAL; John M. Witmer, Lancaster, Pa. App. filed June 11, 1917. Also indicates direction of vehicle.

1,302,622. CONTACT MEMBER FOR VIBRATING CURRENT-CONTROLLING REGULATORS; Vincent G. Apple and Jesse G. King, Dayton, Ohio. App. filed April 23, 1917. Maintains its contact uniformly.

1,302,648. VENTILATION OF STORAGE BATTERIES; Louis H. Flanders, Jenkintown, Pa. App. filed May 10, 1917. Keeps them properly cooled.

1,302,674. CLAMPING DEVICE; Hubert F. Krantz, Brooklyn, N. Y. App. filed Feb. 24, 1913. Suitable for various types of terminal members of switches.

1,302,715. SIGNALING INSTRUMENT; Lloyd B. Salt, Dedham, Mass. App. filed Dec. 24, 1917. By means of light flashes or sound waves.

1,302,736. SAFETY SWITCH; Ira C. Vincent and Barzillai Vincent, Brilliant, Ohio. App. filed Jan. 5, 1916. Disconnecting for arc lamps.

1,302,767. TELEPHONE-EXCHANGE SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed Dec. 17, 1918. Night-alarm service system.

1,302,787. SOCKET FOR INCANDESCENT ELECTRIC LAMP HOLDERS; Alexandre Gouriu, Lyons, France. App. filed Oct. 23, 1918. All the metal parts comprised in it can be cut without any loss.

1,302,788. ELECTRIC FURNACE; Henry Arnold Greaves and Harry Etchells, Sheffield, Eng. App. filed Feb. 12, 1919. Three-phase balanced load obtained with two upper and one lower electrode.

1,302,795. MANUFACTURE OF CARBONS FOR ELECTRIC ARC LAMPS; Walter Heape, London, Eng. App. filed March 26, 1919. Salt of calcium is used.

1,302,796. INSULATOR; Thomas J. Heard, Wilson, Kan. App. filed May 15, 1918. Means for easily attaching wire.

1,302,808. TELEPHONE-EXCHANGE SYSTEM; Charles W. Keckler, Newark, N. J. App. filed Nov. 5, 1917. Periodically interrupted signaling current is impressed upon the called line.

1,302,809. TELEPHONE-EXCHANGE SYSTEM; Charles W. Keckler, Newark, N. J. App. filed May 11, 1918. Expedites handling of connections.

Record of Electrical Patents

Notes on United States Patents

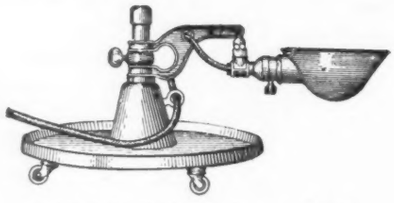
1,302,811. ELECTRICAL CONDUIT INSTALLATION; Homer G. Knoderer, Edgeworth, Pa. App. filed Oct. 3, 1917. Connects two parallel molding conduits in planes at right angles to each other.

1,302,817. ELECTRIC CONTROLLING MEANS; Harry W. Leonard, Bronxville, N. Y. App. filed Oct. 12, 1915. Utilizes vibratory contacts for controlling a winding.

1,302,824. ELECTROLYTIC CELL; Clarence W. Marsh, Greenwich, Conn. App. filed July 14, 1917. Vertical-type cell.

1,302,847. ELECTROMAGNETIC CIRCUIT INTERRUPTER; Harlie O. Putt, Elkhart, Ind. App. filed Dec. 28, 1917. Automatically "times" itself to the peak of the primary current wave regardless of the direction of rotation or speed of magneto.

1,302,851. AUTOMATICALLY RECLOSING CIRCUIT-BREAKER MECHANISM; Estelle C. Raney, Columbus, Ohio. App. filed Oct. 12, 1915. Automatically adapts itself to operate properly.



1,303,061—Portable Lamp Stand

1,302,855. ENGINE GOVERNOR; William Robbins and Harry F. Bryan, Chicago, Ill. App. filed March 12, 1917. Prevents driver from exceeding a predetermined rate.

1,302,871. DISPOSITION OF INFLAMMABLE GASES; Alfred Spice, Jersey City, N. J. App. filed Nov. 10, 1917. Gas burned regardless of the volume.

1,302,887. COMMUNICATION-RECEIVING APPARATUS; Maxmilian Weil, N. Y. App. filed Oct. 19, 1916. Effects complete seal between the receiver and the acoustic passage.

1,302,895. NEGATIVE ELECTRODE FOR SEARCHLIGHTS, PROJECTORS AND THE LIKE; Carl Buchwald, Berlin, Germany. App. filed April 1, 1912. Hard and soft carbon cores embedded in refractory electrode.

1,302,916. ELECTROMAGNETIC CURRENT LIMITER; Trygve Gudem, Christiania, Norway. App. filed March 27, 1918. Takes up and equalizes current shock.

1,302,945. ROTARY RECTIFIER OF ALTERNATING CURRENTS; Constantine D. Macropoulos, New York, N. Y. App. filed Sept. 23, 1918. Comprises a series of insulated disks in electrical connection with insulated collector rings.

1,302,946. ROASTING APPARATUS; William J. Malcolmson, Cicero, Ill. App. filed Aug. 3, 1917. For continuously roasting granular carbon.

1,302,959. PRODUCTION OF ELECTRODES; William K. Page, Chicago, Ill. App. filed Jan. 10, 1916. Insoluble in the electrolyte.

1,302,968. SWITCH FOR ELECTRIC FIRING DEVICES; John N. Powers, Washington, D. C. App. filed June 7, 1916. Instantaneous.

1,303,001. TELEPHONE-EXCHANGE SYSTEM; Ray S. Wilbur, Jersey City, N. J. App. filed June 11, 1917. For controlling the application of signaling current.

1,303,006. ELECTRICAL FIXTURE; Willard J. Allphin, Portland, Ore. App. filed Oct. 5, 1917. Pair of conductors may be tapped or connected to pair of circuit wires.

1,303,007. ELECTRIC BRAZING SWITCH; Peter F. Alzmann, Brooklyn, N. Y. App. filed Sept. 24, 1917. For soldering.

1,303,032. FIREARM; Wheeler D. Cortner, Osawatomie, Kan. App. filed Jan. 22, 1919. Electrical hammer-operating means.

1,303,036. TELEGRAPH SYSTEM; George C. Cummings, East Orange, N. J. App. filed Oct. 23, 1918. Repeater service.

1,303,047. SYNCHRONIZING MEANS FOR MOTION-PICTURE PROJECTORS AND SOUND-REPRODUCING MECHANISMS; Charles W. Ebeling, New York, N. Y. App. filed Sept. 14, 1914. Sound-reproducing mechanism will automatically control motion pictures.

1,303,056. MACHINE-SWITCHING TELEPHONE SYSTEM; Alfred E. Hague, New York, N. Y. App. filed Oct. 30, 1917. Prevents false setting or actuation of selective switches through the accidental transmission of a single impulse.

1,303,061. PORTABLE LAMP STAND; William D. Herwig, Jr., Chicago, Ill. App. filed July 6, 1918. Easily moved and adjusted.

1,303,068. POCKET-LAMP GENERATOR; Oskar Junghans, Schramberg, Germany. App. filed Oct. 10, 1916. Magnet is combined with plates to constitute the casing.

1,303,084. CROSS-BAR LINE SWITCH; Frank A. Lundquist, New York, N. Y. App. filed Nov. 27, 1916. Interconnection between incoming and outgoing lines.

1,303,086. ELECTRIC CIRCUIT CLOSER FOR AUTOMOBILES; Sidney B. Lust, Washington, D. C. App. filed Oct. 9, 1918. Electric horns on automobiles are caused to sound when brakes are applied.

1,303,096. ELECTRIC LIGHT SOCKET; Helmuth Melaun, Indianapolis, Ind. App. filed Oct. 30, 1918. Base is provided with a pair of oppositely extending pins.

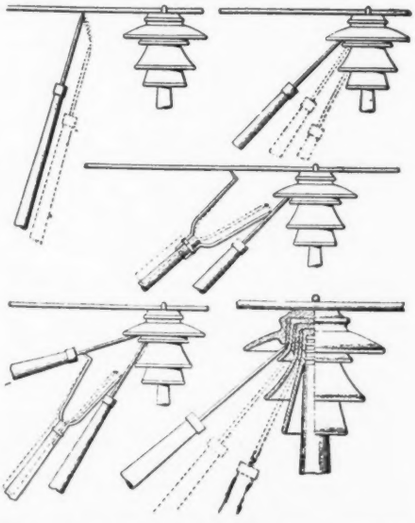
1,303,146. ELECTRICAL MEASURING INSTRUMENT; Harold G. Applegarth and Harold B. Taylor, Wilkinsburg, Pa. App. filed Sept. 10, 1915. For measuring the total volt-amperes traversing one or more electric circuits.

1,303,161. ELECTRIC SWITCH; John F. Cavanagh, Meriden, Conn. App. filed March 30, 1918. Simple tumbler switch.

1,303,162. SPARK COIL; John F. Cavanagh, Meriden, Conn. App. filed Aug. 15, 1918.

1,303,183. PHONOGRAPH TRANSMITTER; Henry C. Egerton, Passaic, N. J. App. filed March 13, 1916. Highly efficient magneto-inductive current generating system.

1,303,184. METHOD OF AND APPARATUS FOR CONTROLLING ELECTRICAL ENERGY; Cornelius D. Ehret, Philadelphia, Pa. App. filed Dec. 29, 1917. By thermionic or electronic action occurring in connection with an audion, pliotron, vapor electric apparatus and the like.



1,303,206—Method of Testing and Locating Defective Multiple-Part Pin-Type Insulators

1,303,188. PUSH-BUTTON ATTACHMENT FOR STEERING POSTS; Eugene D. Ferrell Wayzata, Minn. App. filed Jan. 22, 1917.

1,303,206. METHOD OF TESTING AND LOCATING DEFECTIVE MULTIPLE-PART PIN-TYPE INSULATORS; Tomlinson F. Johnson, Jr., Atlanta, Ga. App. filed Oct. 31, 1918. Can be used without interruption of service.